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MITIGATION OF CHLORINATED SOLVENT GROUNDWATER PLUMES WITH COLLOIDAL ACTIVATED CARBON

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MITIGATION OF CHLORINATED SOLVENT GROUNDWATER PLUMES WITH COLLOIDAL ACTIVATED CARBON.

BY

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ABSTRACT

Chlorinated volatile organic solvents (CVOCs) can form a contamination plume in groundwater that needs to be managed to protect human health and the environment. There are many injectable products available to treat contamination plumes in groundwater using a number of specific technologies, individually and in combination. This study evaluates the effectiveness of injectable colloidal activated carbon (PlumeStop® Liquid Activated Carbon™) at two sites in Rhode Island with chlorinated solvent groundwater contamination plumes. The injectate was introduced via low-pressure injection methods to avoid mobilizing additional contaminants.

The initial results show a reduction in contaminant levels downgradient of the injection points for both Sites. The long-term effectiveness of the injectate remains to be seen. GZA will continue to monitor the groundwater quality downgradient of the injections to evaluate breakthrough of the Permeable Reactive Barrier (PRB) formed by the PlumeStop injections.

ACKNOWLEDGMENTS

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CHAPTER 1

INTRODUCTION

Chlorinated volatile organic solvents (CVOCs) can form a contamination plume in groundwater that needs to be managed to protect human health and the environment. There are many injectable products available to treat contamination plumes in groundwater using a number of specific technologies, individually and in combination. This study evaluates the effectiveness of injectable colloidal activated carbon at two sites. The first site (Site I) is the Central Landfill Superfund Site in Johnston, Rhode Island. The second site (Site II) is a Former Plating Facility in Providence, Rhode Island.

Site I Central Landfill Background

The Central Landfill Superfund site is a solid waste disposal facility in Johnston, Rhode Island. The Site has a long history of use as a solid waste disposal facility spanning from approximately 1955 to the present. Phase I of the landfill is a 121-acre cell that is unlined underneath the landfill. Phase I began operation in 1955 and was closed in 1997. The current extent of the landfill occupies approximately 154-acres on a 1,330-acre property. An engineered cap has been installed over the 154-acre landfill. The engineered cap includes an 80-mil LLDPE liner. The landfilling operations filled in the former Cedar Swamp Brook. Groundwater flow through the landfill generally follows the former path of Cedar Swamp Brook, (Figure 1).

Between 1976 and 1979 a portion of Phase I was used for liquid industrial waste and hazardous waste disposal. This area, covering less than one acre along the eastern

flank of the Phase I Landfill, was identified through aerial photograph analysis conducted by the EPA and has been designated as a Hot Spot. The Hot Spot is the primary identified source of a Volatile Organic Compound (VOC) plume in groundwater derived primarily from the presence of dense, non-aqueous phase liquids (DNAPLs). The predominant VOCs detected in the Hot Spot groundwater plume are chlorobenzene and 1,2-dichlorobenzene.

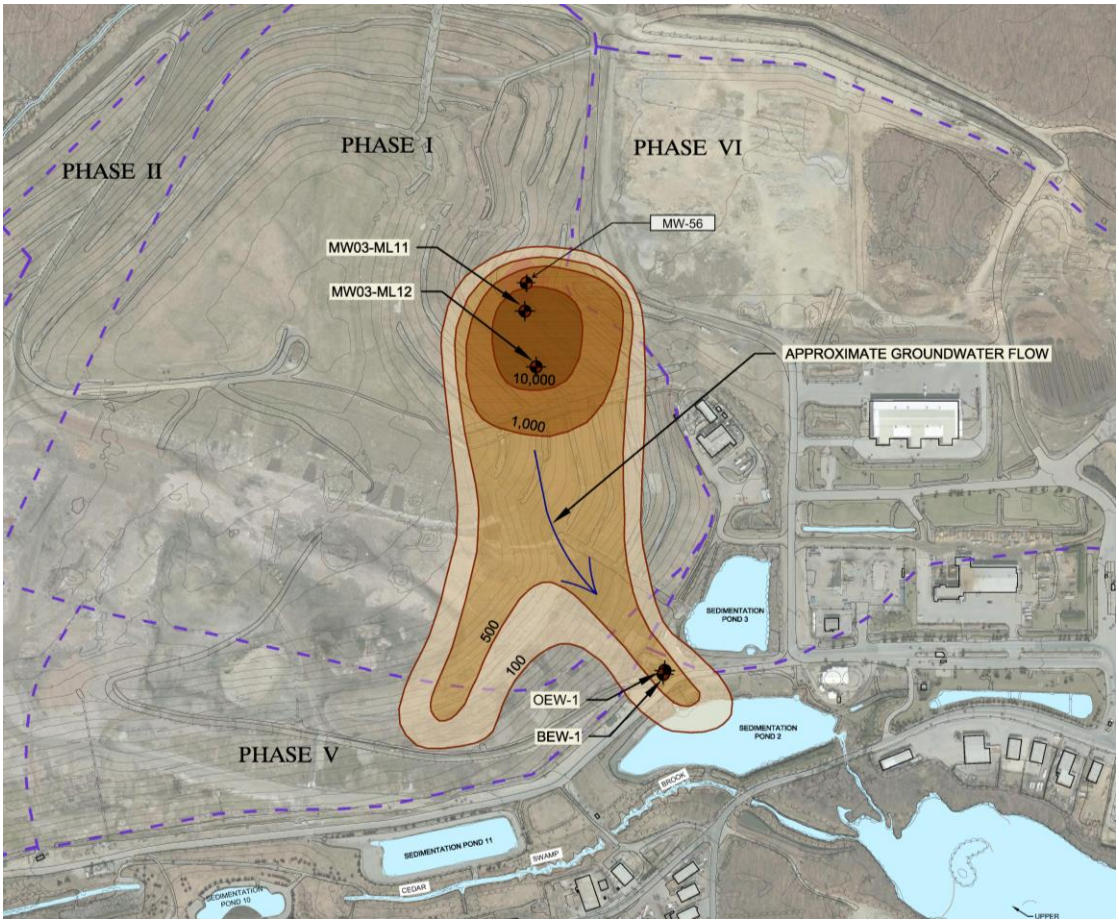

Figure 1: Plan View of Contamination plume, and Monitoring Wells of Central Landfill.

GZA GeoEnvironmental Inc. (GZA) operated a groundwater pump and treat system, herein referred to as the Hot Spot Hydrodynamic Containment System (HSHCS) from 2004 to 2016. The HSHCS extracted groundwater from source area

well MW03-ML11 (herein referred to as ML-11). Based on the groundwater monitoring data for ML-11, GZA determined that the plume had migrated beyond the ML-11 extraction well. Therefore, a new series of extraction wells were installed downgradient to capture the remaining plume.

As part of the decommissioning of extraction well ML-11, the United States Environmental Protection Agency (EPA) requested in-situ treatment of the source area around ML-11. After evaluating treatment alternatives, PlumeStop® Liquid Activated Carbon™ (PlumeStop) was selected as the preferred treatment method for the source area. PlumeStop was selected over alternative treatment methods because it can be injected at low pressures due to its water-like viscosity. PlumeStop is composed of colloidal scale (1 to 2 micron) activated carbon particles applied in an aqueous solution. The particles are manufactured with an anti-clumping agent (polymer coating). PlumeStop is designed to absorb and immobilize contaminants once the polymer coating breaks down, refer to Figure 2 depicting the general process.

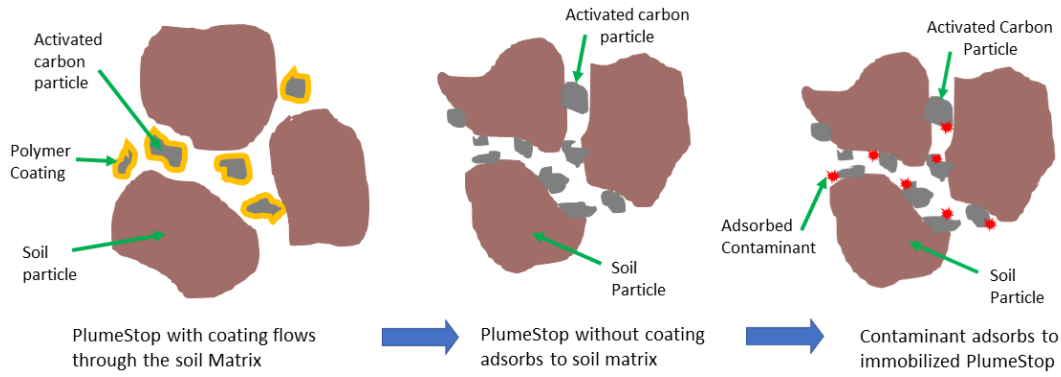

Figure 2: PlumeStop General Process Diagram

The PlumeStop injection was anticipated to minimize the risk of causing contaminant migration during the injection process and form a Permeable Reactive

Barrier (PRB) to treat the plume. Based on information provided by the manufacturer, PlumeStop adsorption sites are regenerated as the contaminant is bio-degraded, therefore, PlumeStop is expected to provide long term mitigation of the source area, refer to Figure 3 for the treatment process flow diagram.

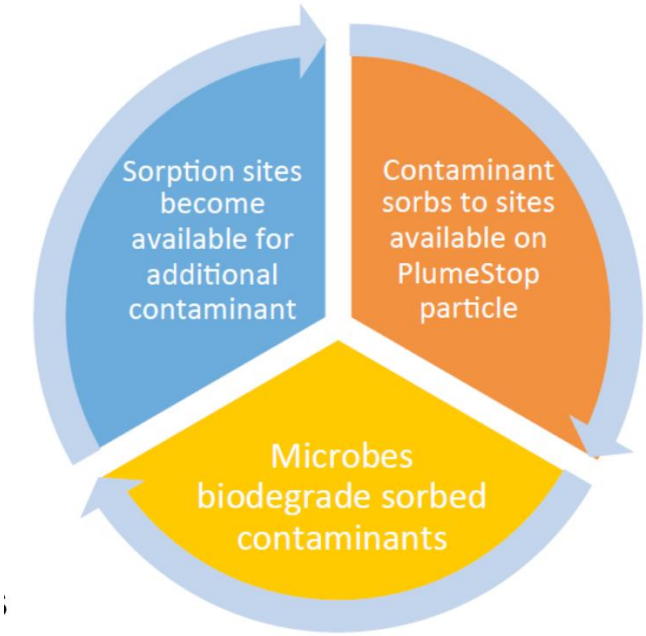

Figure 3: PlumeStop Treatment Process Flow Diagram

ML-11 consists of a bedrock extraction well which is a 4-inch diameter, 189-foot deep well. Depth to groundwater in ML-11 is typically 85 feet below grade. The well is equipped with casing from the ground surface to a depth of 83-feet below grade (approximately the thickness of the landfill) and is an open borehole in fractured bedrock below that depth. The bedrock in the area consists of an igneous granite gneiss with no primary porosity or permeability, therefore groundwater movement and associated contaminant migration is limited to bedrock fractures. Figure 4 presents the profiles of ML-11 and the downgradient monitoring well ML-12. Monitoring well

ML-12 is a multi-level well with well screened intervals 12A (elevation 317.6 feet to 328.6 feet), 12B (elevation 279.6 to 300.6 feet), MLC (elevation 235.6 to 245.6 feet), MLD (elevation 209.6 to 222.6 feet), and 12E (elevation 148.6 to 158.6 feet).

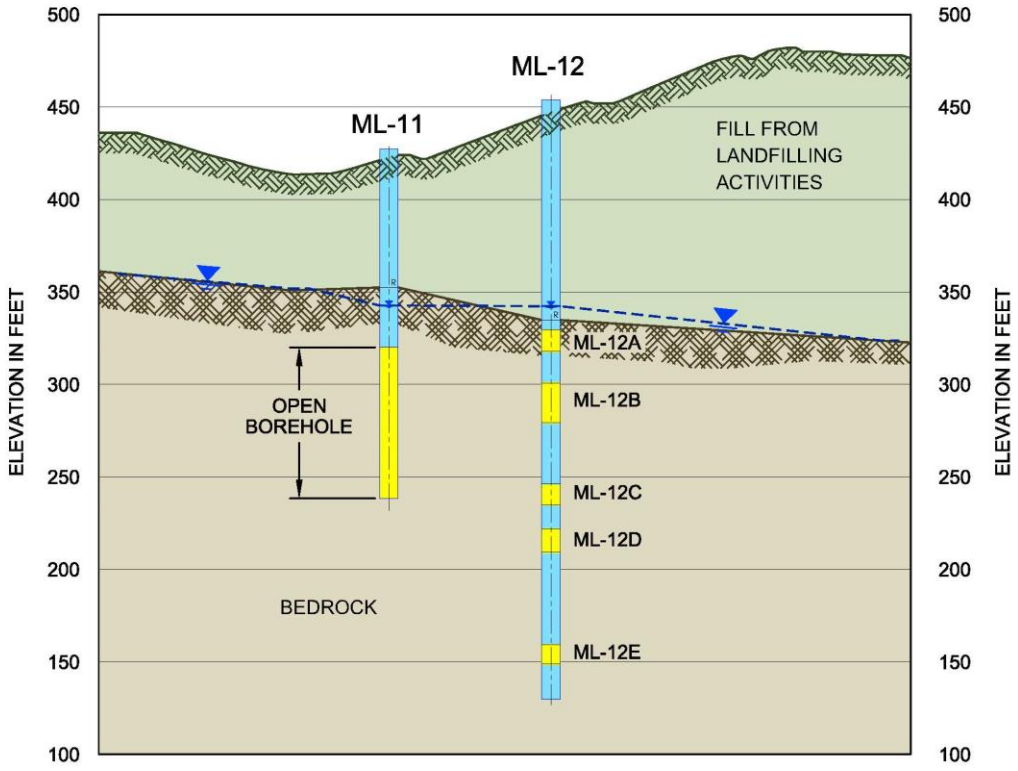

Figure 4: Profiles of Monitoring Wells ML-11 and ML-12

GZA conducted packer testing of ML-11 in 2003 to evaluate the hydraulic conductivity of bedrock in the vicinity of the borehole. The packer testing consisted of lowering two inflatable packers into the open borehole of the well to isolate 5-foot intervals of the exposed bedrock. The groundwater in the 5-foot interval is then evacuated, and the time to fill the void with groundwater is measured to estimate the hydraulic conductivity of the interval. Bedrock packer permeability testing was performed in approximately 5-foot intervals starting below the steel casing and

running the length of the borehole. These data were used to estimate the bedrock hydraulic conductivity. As a part of previous investigations, GZA also conducted a suite of geophysical testing on ML-11 in 2003, including digital acoustic televiewer (ATV) logging. Based on the ATV logging and bedrock packer permeability testing described above, GZA calculated the average hydraulic aperture (i.e., effective fracture opening size) for ML-11. The hydraulic aperture for each ML-11 packer test zone ranged between 15 to 110 microns, this aperture size is large enough to accommodate the 1-2-micron sized PlumeStop particles.

Site II: Former Plating Facility Background

A former metal plating facility in Providence, Rhode Island is contaminated with chlorinated ethenes and their breakdown products (tetrachloroethene (PCE), trichloroethene (TCE), cis 1,2-dichloroethene (DCE) and vinyl chloride (VC)) from jewelry plating operations. The approximately 0.5-acre site consists of a paved parking area. Soil strata at the site generally consist of approximately 2-5 feet of fill (urban fill), underlain by approximately 4-15 feet of silty sand and/or sand and silt. The site is equipped with a Soil Vapor Extraction (SVE) system, and groundwater monitoring wells GZ-2 through GZ-10, and MW-2D. The SVE system remediates contamination above the static water table at the Site, but not below the static water table.

In September 2011, a combined abiotic/biotic enhanced reductive dechlorination (ERD) remedy involving injection of zero valent iron (ZVI) and organic carbon electron donors (lactose and inactivated yeast) was implemented in contaminant source areas at the Site, below the static water level. ERD remediation is a process that breaks down PCE into daughter products like TCE, DCE and VC through

sequential removal of chlorine molecules from the ethene structure. When reductive dichlorination is occurring reductions in PCE concentrations result in a corresponding increase in TCE, reductions in TCE have a corresponding increase in DCE, and reductions in DCE have a corresponding increase in VC. The ZVI injections significantly reduced PCE and TCE (increased daughter products like DCE and VC) initially; however, contaminant levels began increasing (rebounded) in 2015. Groundwater monitoring results suggested that reductive dechlorination was still occurring onsite. However, the data also suggest that supplemental treatment along the downgradient edge of property would be beneficial for continuing the remediation process and minimizing offsite plume migration. After reviewing alternatives, PlumeStop was selected as the preferred treatment alternative. The PlumeStop injections serve as a PRB to mitigate offsite migration of contaminants.

For both sites the PlumeStop activated carbon injectate was paired with Hydrogen Release Compound (HRC). The HRC stimulates bacterial growth to jumpstart the bioremediation process. Therefore, the overall treatment from the injection of PlumeStop and HRC should reduce contaminant concentrations by adsorption and biodegradation.

CHAPTER 2

REVIEW OF LITERATURE

There are many alternatives for implementing PRBs for in-situ treatment of groundwater contamination plumes. Traditional PRBs require trench excavation and fill utilizing the proposed treatment compound, such as granular ZVI, activated carbon, or other reactive materials (Tosco, et al. 2014). Due to limitations (e.g., high cost, spatial constraints, etc.) for installation of PRB via excavation, injectable treatment materials have been developed. Nanoscale ZVI particles are commonly used for remediation because they can be injected into the soil matrix, and due to their large surface area Nano-ZVI has been shown to be more effective at degrading contaminants than granular ZVI (Zhang, et al. 1998). Although Nanoscale ZVI particles are small enough to pass through the soil matrix, the mobility of these particles is limited due to agglomeration and adhesion to the soil matrix (O-Carroll, et al. 2013). Nano-ZVI particles can be modified with various coatings and metal catalysts or suspended in emulsions to improve their mobility and efficacy (Comba, et al. 2011). Similar to Nano-ZVI, granular activated carbon is also an effective material for PRBs (Ruiz, et al. 2014). However, granular activated carbon particles also have limited mobility in the soil matrix.

Regenesis® (San Clemente, California) has developed an activated carbon-based injectate called PlumeStop® Liquid Activated Carbon™ (United States of America Patent No. 9,770,743, September 26, 2017).

The polymer coating improves the ability to distribute the activated carbon into the soil matrix, by preventing the particles from adhering to each other or to soil particles. The PlumeStop colloidal mixture has similar viscosity to water. As the coating degrades, the activated carbon particles adhere to the soil matrix and/or bedrock and form a matrix that promotes bacterial growth. Figure 5 below, depicts a Scanning Electron Microscope (SEM) image of sand particles without PlumeStop, Figures 6 and 7 depict SEM images of sand particles with PlumeStop coating. Note, Figures 5 through 7 have differing scales. The sand particles depicted in the Figures are approximately the same size.

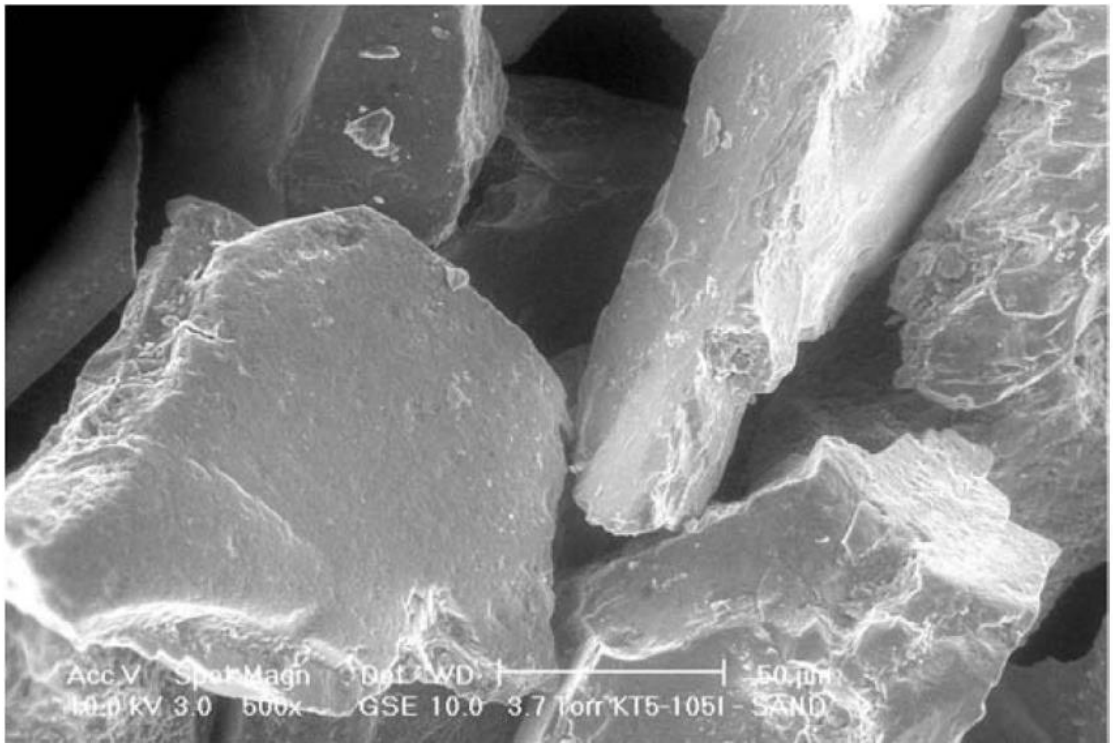

Figure 5: SEM Image of Sand Particles without PlumeStop (Provided by Regenesis)

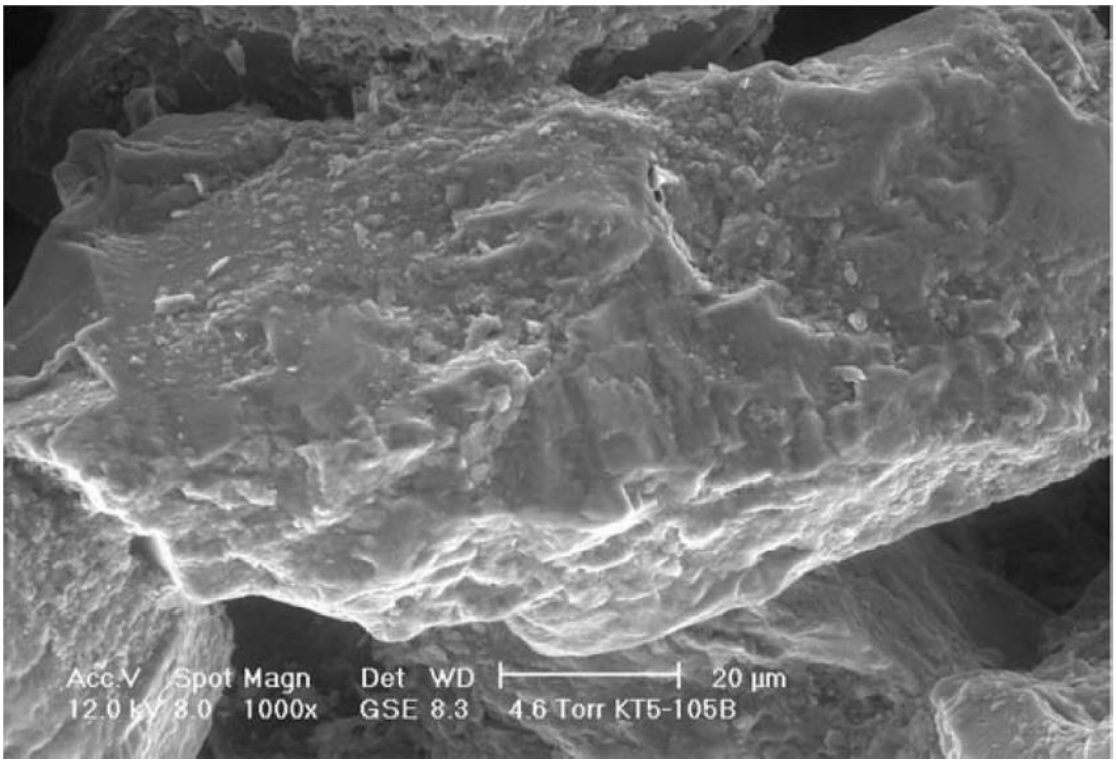

Figure 6: SEM Image of Sand Particles Coated with PlumeStop (provided by Regenesis)

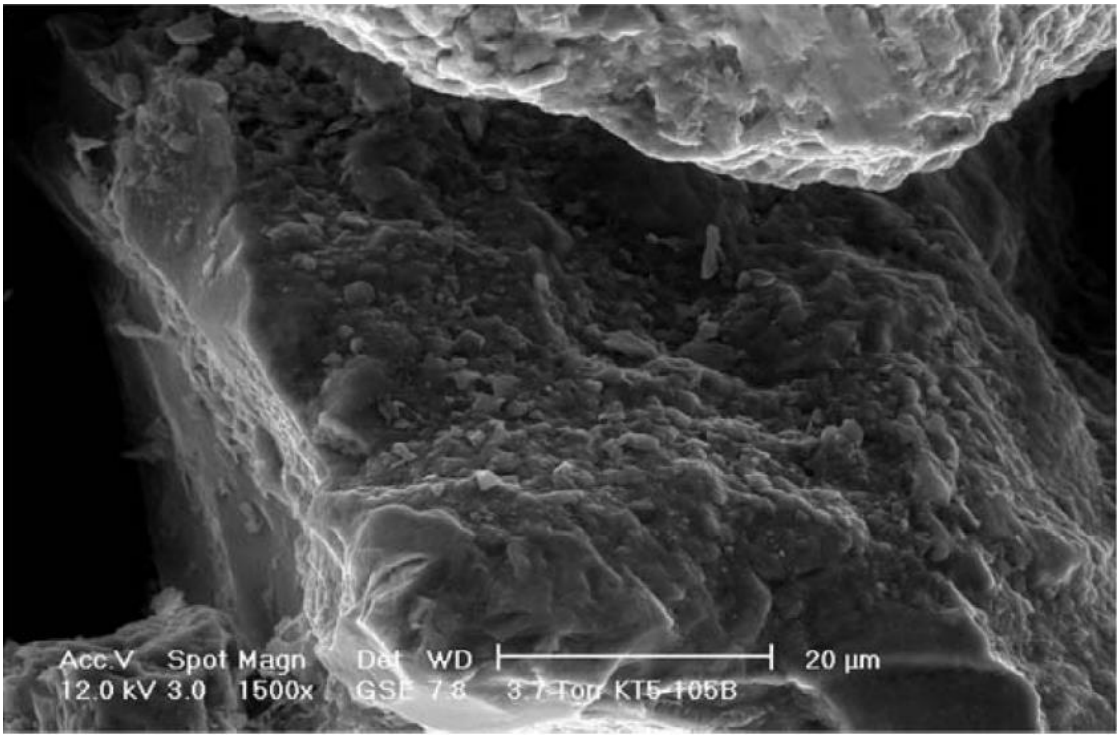

Figure 7: SEM Image of Sand Particles coated with PlumeStop (provided by Regenesis)

The PlumeStop is intended to form a bio-remediation barrier in the soil matrix. As contaminated groundwater migrates through the PRB formed by the PlumeStop particles, contaminants adsorb to the carbon surface and should degrade more effectively due to the longer residence time and direct contact with bacteria. According to the manufacturer, as the contaminants degrade, adsorption sites again become available to adsorb additional contaminant (Birnstingl, et al. 2014) allowing for long term mitigation of contaminant plumes. In order for the long-term treatment to be effective, biodegradation of the contaminants of concern must be possible, and the rate of biodegradation must be greater than or equal to the rate of adsorption under saturation conditions. The sorption capacity of PlumeStop depends on the surface area of the activated carbon particles. Information provided by Regenesis does not provide the surface area to mass ratio for PlumeStop. However, published data for surface areas of activated carbon products can range from 34 m^2/g (Jaroniec et al. 1989) to 2696 m^2/g (Lih, E. Y. et al. 2016).

PlumeStop is an aqueous-phase amendment (i.e., active only in the saturated portion of an aquifer) that is typically injected via direct push injection methods but can also be emplaced using monitoring wells and open boreholes.

This study evaluates the effectiveness of PlumeStop injections at two sites. Both sites contain chlorinated solvents. The main contaminants of concern at Central Landfill are 1,2-dichlorobenzene and chlorobenzene. Both 1,2-dichlorobenzene and chlorobenzene have been found to biodegrade from bacterial growth/metabolism (Reineke et al. 1984) (Haigler et al. 1988) (Seignez et al. 2001) (Ziagova et al. 2007).

The main contaminants of concern at the Former Plating Facility are PCE, TCE, DCE, and VC. Under anaerobic conditions PCE undergoes reductive dichlorination/biodegradation to form TCE, which is dechlorinated to DCE, and ultimately VC (Ni, Z. et al. 2014) (Bradley 2000). Given that the contaminants of concern for both sites can undergo bioremediation, long-term treatment should be possible.

At Central Landfill PlumeStop was injected via low-pressure gravity feed into fractured bedrock and at the Former Plating Facility direct push injection methods were utilized to inject PlumeStop into silty sand soils. Direct Push Injection is a process where a probe or in this case tubing is pushed into the ground via vibratory or percussion hammering instead of drilling. In situ groundwater treatment in fractured bedrock is an emerging technology and the effects of chemical injection into bedrock can be highly variable due to preferential flow paths (i.e., treatment may be observed in some areas and not others due to the heterogeneous nature of fractured bedrock).

CHAPTER 3

METHODOLOGY

Central Landfill Injection Methods and Procedures

First Injection June to July 2016

The injectate was introduced to the former bedrock extraction well by gravity feed. Direct push injection is typically the method used to inject PlumeStop, however, this method is not possible at Central Landfill because it would require puncturing the landfill cap liner. Instead of direct push, the PlumeStop was added via gravity feed to ML-11 to avoid puncturing the liner. The low-pressure gravity feed injection approach was chosen over other remediation technologies to avoid altering site hydrodynamic conditions and limit the potential to alter current contaminant distribution patterns. During the injections the hydraulic head was limited to approximately 10 feet (4.3 pounds per square inch) above the static water level in the well. Dense Non-Aqueous Phase Liquid (DNAPL) is known to be present within the bedrock aquifer in the Hot Spot area, therefore, it was important to avoid injecting any of the additives under significant pressure because of the potential to mobilize contaminant source material to areas that are currently un-impacted. Based on GZA's evaluation of hydraulic conductivities and fracture spacing in ML-11, it was determined that injection within a specific well bore zone using zone isolation packers was not necessary and would increase the risk of applying a large hydraulic head to the borehole fractures.

The ML-11 extraction system (HSHCS) was removed from service in April 2016, and the static water level was allowed to equilibrate (2 months) prior to the injection.

In preparation for the in-situ treatment program, the injection well (ML-11) was developed to remove accumulated sediment to increase the injection rate. The well development process essentially cleans the borehole to remove sediment and improve the hydraulic conductivity of the borehole.

A total of 1,200 pounds (lbs.) of PlumeStop was mixed with potable water in 50-gallon batches and applied via gravity-feed injection as a 15% (by volume) colloidal solution. Approximately 250 gallons of 15% PlumeStop were injected into ML-11 once a week for five weeks. The total volume of injectate was approximately 1,250 gallons. Following the final PlumeStop injection, approximately 150 pounds of a lactate-based anaerobic bioremediation additive, Hydrogen Release Compound® (HRC, containing glycerol tri-polylactate, glycerin, and lactic acid), was mixed 1:1 with potable water and injected into the borehole. The HRC serves as an electron donor for dechlorinating bacteria by degrading to fatty acids and hydrogen.

The injectate was mixed in 50-gallon batches, and pumped from the base of the landfill, in the vicinity of the Hot Spot treatment system up to ML-11. Flow rates were adjusted during the injection event to maintain less than 10 feet of hydraulic head above the static water level. Each 50-gallon batch required approximately 1.5 to 2 hours to inject. During the first day of injections, GZA attempted to continuously circulate water within the borehole using a small submersible pump[1]. However, the submersible pump failed shortly after the first injection began. GZA repeated this attempt to circulate water in the borehole using submersible pumps, the second and

[1] The purpose was to prevent separation of the PlumeStop material from the aqueous carrier, but through field observations and discussion with the manufacturer we determined that this was not necessary.

third day of injections, however these pumps also failed. During the fourth and fifth days of injections, the water in the borehole was not circulated.

Second Injection July to August 2017

A total of 800 lbs. of PlumeStop was mixed with potable water and applied via gravity-feed injection as a 12 to 15% (by volume) colloidal solution. The second injection of PlumeStop utilized a different formulation of the injectate. The formulation for the second injection had a thinner coating of polymer on the activated carbon particles. This formulation is intended to fall out of suspension in the groundwater faster and adhere to the soil matrix closer to the injection point.

Approximately 200 gal. of PlumeStop colloidal solution was injected into ML-11, once a week for four weeks. The total volume of injectate was approximately 800 gallons. Following the final PlumeStop injection, 30 lbs. of a fermentable, lactate-based organic carbon source HRC was gravity-injected, to serve as an electron donor (fatty acids and hydrogen) for dechlorinating bacteria. GZA mixed 200-gallon batches at the beginning of each day at the landfill plateau. The injectate was then gravity fed via 1.5-inch tubing from the plateau to ML-11. Again, the hydraulic head was limited to 10-feet above the static water level. During this round of injections, GZA attempted to also inject PlumeStop into an upgradient monitoring well (MW56). MW56 is a 2-inch diameter well with PVC casing extending into shallow bedrock approximately 90 feet below grade with a well screen at depths of 331.6 to 341.6 feet bgs. After adding approximately 10-gallons to MW56, the water level rose to approximately 25-feet above the static water level. The flow of injectate was stopped, and the water level was

allowed to drop down to the static water level. Due to the low hydraulic conductivity observed, no additional injections were attempted in MW56.

Third Injection March to April 2018

A total of 2,000 lbs. of PlumeStop were injected into MW11 via gravity-feed injection as a 12 to 15% (by volume) colloidal solution in batches over the course of eight weeks. The total volume of injectate was approximately 2,100 gallons. The hydraulic head was again limited to 10 feet above ambient to limit the potential for migration of non-aqueous phase contaminants in the aquifer. Following the final PlumeStop injection, 30 lbs. of the HRC organic carbon source was gravity-injected, to serve as an electron donor for dechlorinating bacteria. Following the third injection, ML-11 was decommissioned (filled with a cement-bentonite grout and closed) in order to accommodate additional landfilling activities in the area.

Post Injection Monitoring

Following the first injection event, groundwater samples were collected from ML-11 and MW03-ML12 (zones A through E) on a monthly basis for VOC analysis for three months and quarterly thereafter. ML-12 is the closest downgradient monitoring point to ML-11 (located approximately 230 feet downgradient of ML-11). After the second and third injections, sampling was performed on a quarterly basis. ML-11 was decommissioned in April 2018, shortly after the third injection. The last sampling round of ML-11 was performed in February 2018. Quarterly sampling of ML-12 is ongoing, the most recent sampling round was performed in May 2019.

Samples were collected utilizing pneumatic pumps integral to the Solinist Multi-Level Well system in general accordance with the USEPA's September 19, 2017 Low Stress (low flow) Purging and Sampling Procedure (EPA SOP-001).

During the sampling, field readings were recorded for pH, temperature, specific conductance, turbidity, Oxidation-Reduction Potential (ORP) and dissolved oxygen (DO) using an YSI Multi-meter® with a flow-through cell and a LaMotte 2020 turbidity meter. Depths to groundwater were also recorded during sampling. The field readings indicate whether the well has stabilized (i.e. if the groundwater in the well is representative of the groundwater in the soil matrix) and is ready to be sampled. Groundwater samples were collected in Laboratory-provided, hydrochloric acid-preserved 40 ml glass vials with septa caps and were used for aqueous phase VOC analysis via EPA Method 8260B. The samples were packed in an ice chest and transported under chain-of-custody protocol to Microbac Laboratories Inc. located in Dayville, CT for analysis.

The sampling and laboratory analysis were conducted in accordance with GZA's Sampling and Analysis Plan (SAP) and the Quality Assurance Project Plan (QAPP) for the Hot Spot Groundwater Containment System for the Central Landfill dated March 2004.

Former Plating Facility Injection Methods and Procedures

From August 15 through 18, 2016, the injectate was introduced to 19 injection points IP-1 through IP-19 via direct push method. The direct push method of injection involves installing the injection tubing to depth (in this case 20-feet below ground surface) and adding the injectate as the tubing is withdrawn. HRC was applied to all

but two injection points a day before the PlumeStop injections. HRC was not injected in IP-12 and IP-19. HRC was not applied to IP-12 because this injection point hit refusal at 5 feet bgs. IP-19 was created the day of the PlumeStop injections (i.e. the day after the HRC injection). IP-19 was added to the injection program because IP-10 was abandoned during the PlumeStop injection due to the appearance of PlumeStop that was observed in monitoring wells MW-2D and GZ-4 during the injection.

A total of 4,400 pounds (lbs.) of PlumeStop was mixed with potable water to make a 10 percent (%) solution, approximately 4,000 parts per million (ppm), and injected via Geoprobe® Direct Push Technology (DPT) into 19 points (Figure 8 below, Injection Points IP-1 through IP-19), between approximately eight (8) and twenty (20) feet below ground surface. As described above IP-12 hit refusal at 5 feet below ground surface and was abandoned, IP-10 was also abandoned due to the appearance of PlumeStop in the downgradient wells during the injection. The injections generally followed the downgradient edges of the parking lot for the former plating facility, forming a bioremediation barrier approximately 90 feet long and eight to 20 feet below the ground surface. Note, depth to the static water level at the site ranges from eight (8) to thirteen (13) feet below ground surface. Approximately 24 gallons (gal) of PlumeStop solution were injected per vertical foot. In addition to PlumeStop, 18 liters of bioaugmentation culture (Bio-Dechlor Inoculum® Plus, BDI Plus: *Dehalococcoides* dechlorinating bacteria) and 540 lbs. of HRC organic carbon electron donor was injected at each interval. Approximately 60 mL of sodium bisulfite was added to every 300 gallons of PlumeStop to deoxygenate the solution prior to injection.

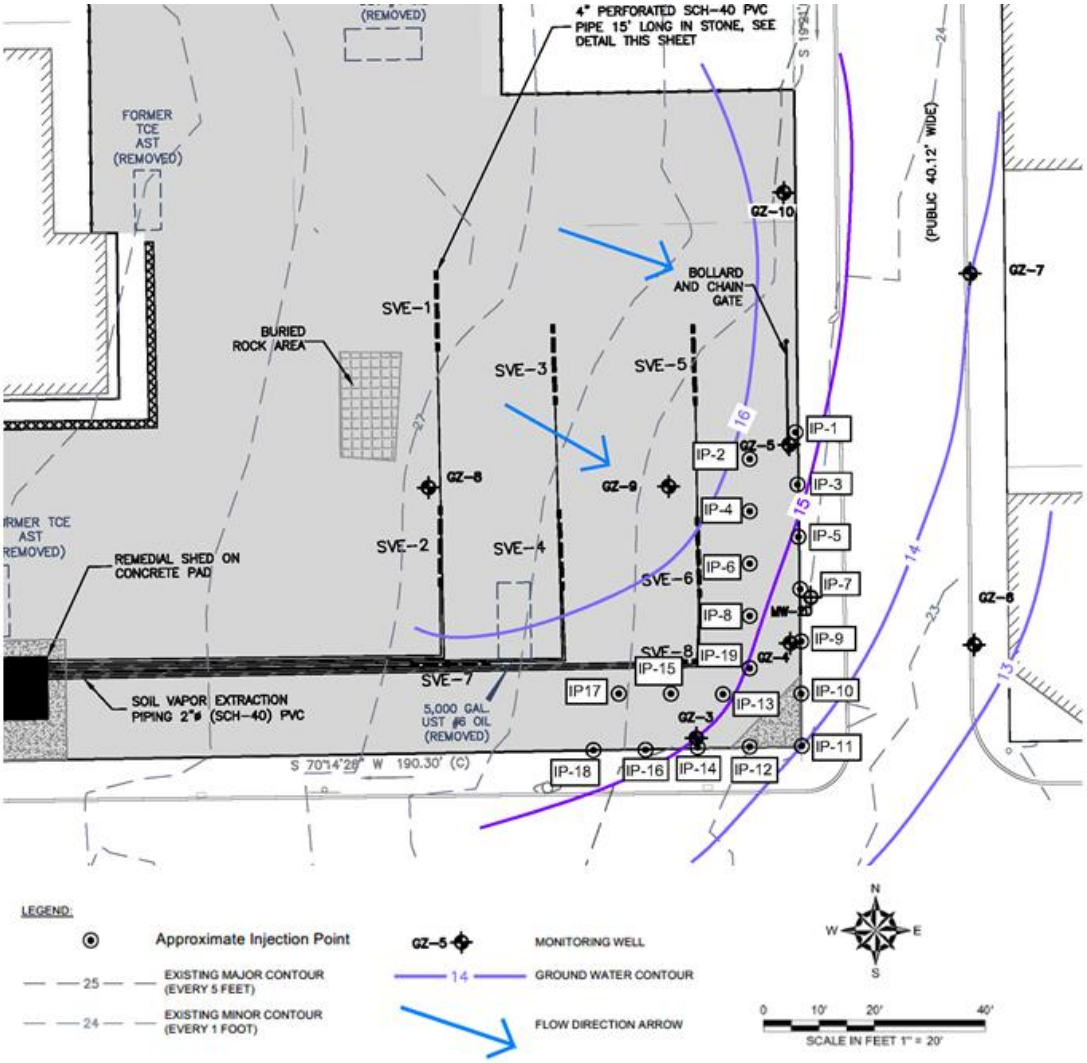

Figure 8: Former Plating Facility Injection Points and Monitoring Wells

Former Plating Facility Post Injection Monitoring

Immediately prior to and following the PlumeStop injection, groundwater samples were collected from each of the wells and analyzed for VOCs. Samples were collected utilizing EPA SOP-001. Sampling is performed for all of the wells onsite on a semi-annual basis. The most recent sampling round was performed in March 2019. During groundwater sampling, a variable speed peristaltic pump was utilized to

control the rate of purging. Dedicated 3/8-inch diameter polyethylene tubing was installed in each of the wells and dedicated pharmaceutical grade (silicone) tubing was utilized as the pump head tubing.

During the sampling, field readings were recorded for pH, temperature, specific conductance, turbidity, Oxidation-Reduction Potential (ORP) and dissolved oxygen (DO) using an YSI Multi-meter® with a flow-through cell and a LaMotte 2020 turbidity meter. Depths to groundwater and purging flow rate measurements were also recorded during sampling. The field readings are utilized to determine if the well has stabilized and is ready for sampling. The samples were placed in laboratory provided, hydrochloric acid-preserved 40 ml glass vials with septa caps for VOC analysis via EPA Method 8260B. The samples were then packed in an ice chest and transported under chain-of-custody protocol to ESS Laboratory in Cranston, RI.

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CHAPTER 4

FINDINGS

Central Landfill Facility

During the operation of the HSHCS pump and treat system, monthly samples were collected from ML-11 and quarterly samples were collected from ML-12. The results of the sampling for ML-11 and ML-12 from 2015 to present are provided in the Tables 2 through 8. Due to fluctuations in the concentration of contaminants, the Figures depict a 12-month moving average of the sampling results for ML-11 and ML-12. Generally, the concentration of contaminants increases during periods with a low groundwater table and decreases during periods with a high groundwater table due to dilution. The concentrations of contaminants are also impacted by the degradation of 1,2-dichlorobenzene to chlorobenzene. Generally, the concentrations of 1,2-dichlorobenzene and chlorobenzene tend to correlate based on fluctuations in the groundwater table.

ML-11 Results

The HSHCS ceased operation in April 2016. ML-11 was an open borehole from elevation 344.2 feet to 238.2 feet (i.e., 83 feet to 189 feet bgs). Prior to the injection, the concentration of 1,2-dichlorobenzene in samples from ML-11 ranged from approximately 9,000 µg/L to 17,000 µg/L. The concentration of chlorobenzene in ML-11 ranged from 1,700 to 7,200 µg/L prior to the injection.

Figures 9 and 10, show the sampling results for 1,2-DCBZ and CBZ in ML-11 from January 2015 to February 2018. This well was decommissioned shortly after the

third injection in order to accommodate additional landfilling activities in the area. Figures 9 and 10 show that the 12-month moving average concentration of chlorobenzene and 1,2-dichlorobenzene in ML-11 have decreased since the first injection. The addition of the injections can dilute contaminant concentrations temporarily. Refer to Appendix B for calculations of potential contaminant reduction due to dilution.

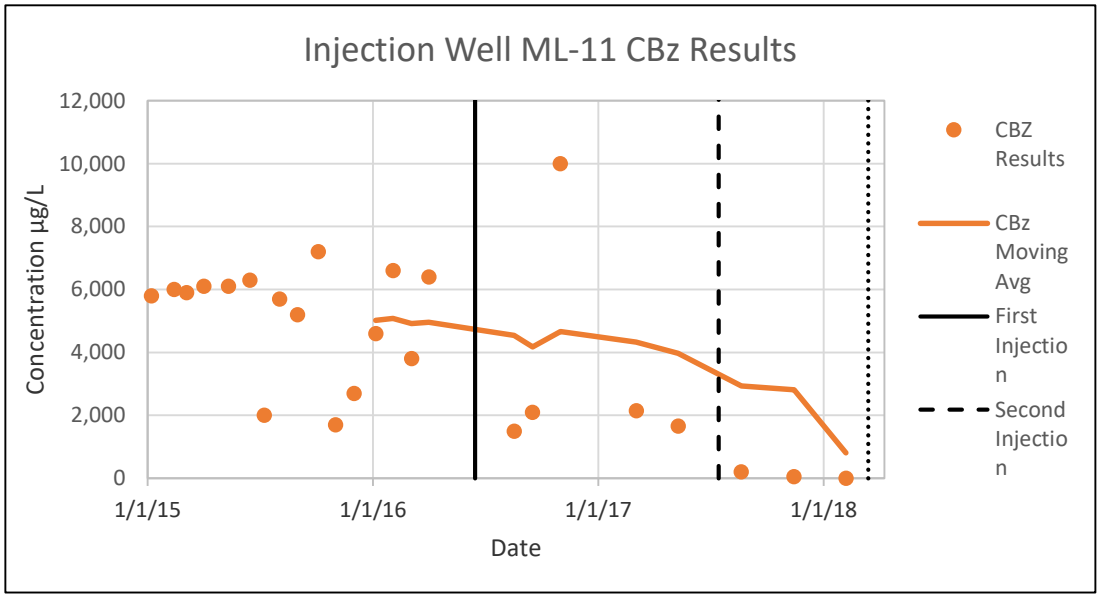

Figure 9: Chlorobenzene Results in ML-11

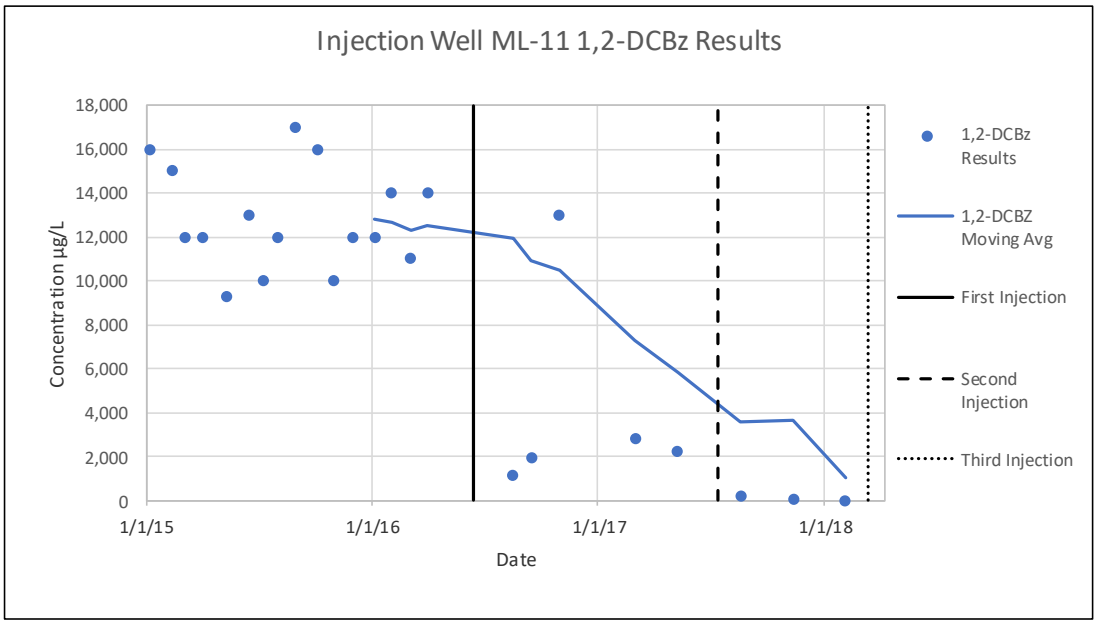

Figure 10: 1,2-Dichlorobenzene Results in ML-11

As shown in Table 2, after the first injection, the concentrations of 1,2-dichlorobenzene in ML-11 decreased from 14,000 µg/L to less than 2,000 µg/L during the August and September sampling rounds. The concentration of 1,2-dichlorobenzene then rebounded to 13,000 µg/L during the October sampling round. This rebound suggests that the PlumeStop migrated downgradient of ML-11 as intended. The concentration of chlorobenzene decreased from 6,400 µg/L in April to 1,500 µg/L in August and 2,100 µg/L in September. The chlorobenzene concentration in October rebounded to 10,000 µg/L. The rebound observed in October is considerably higher than the concentration of chlorobenzene prior to the injection, which may be the result of mobilizing contaminants due to the injection.

Due to the different formulation of PlumeStop used for the second injection, the impacts of the second injection are expected to be more localized around ML-11.

Rebound is not observed in ML-11 after the second injection, as expected because the formulation of the second injection was designed to fall out of suspension faster and would therefore provide treatment closer to the injection well.

ML-12 Results

As depicted in Figures 11 through 20 below, the 12-month average concentration of chlorobenzene and 1,2-dichlorobenzene in downgradient well ML-12 also appear to be trending downward since the first injection. However, the downward trend observed in ML-12 is less pronounced than the trend for ML-11. Note, this well is approximately 230 feet downgradient of ML-11, and there is a delay of approximately 3-9 months (depending on groundwater table fluctuations) before any changes in ML-11 appear in ML-12.

The well screen for ML-12A is installed from elevation 317.6 to 328.6 (i.e., 136 feet to 125 feet bgs). During the operation of the HSHCS, ML-12A experienced less drawdown then the lower well screen sections, which indicates that ML-12A is not as hydraulically connected to ML-11 as the other well screens in ML-12. Therefore, the reduction in contaminant concentrations in ML-12A is not observed. Prior to the injection, the concentrations of 1,2-dichlorobenzene in ML-12A ranged from approximately 800 µg/L to 3,900 µg/L and the concentrations of chlorobenzene ranged from approximately 500 µg/L to 3,600 µg/L. Since the third injection the concentration of 1,2-dichlorobenzene ranged from 730 µg/L to 2,500 µg/L, and the concentration of chlorobenzene ranged from 500 µg/L to 1,800 µg/L. The shape of the 12-month moving averages depicted in Figures 11 and 12 are similar because the

concentration of both 1,2-dichlorobenzene and chlorobenzene are affected the same way by fluctuations in the groundwater table.

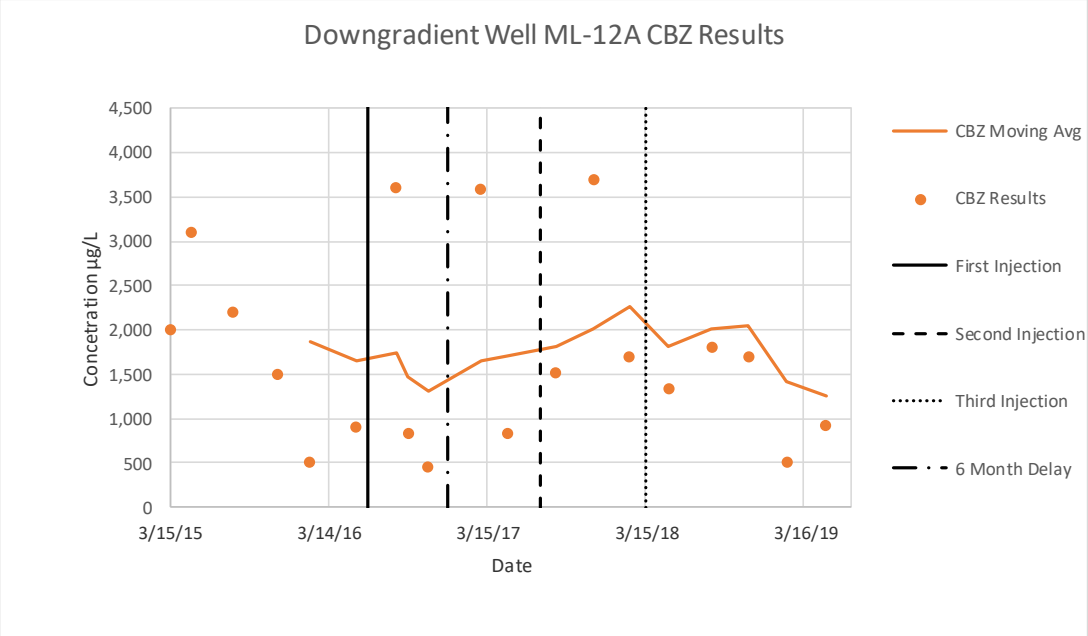

Figure 11: Chlorobenzene Results in ML-12A

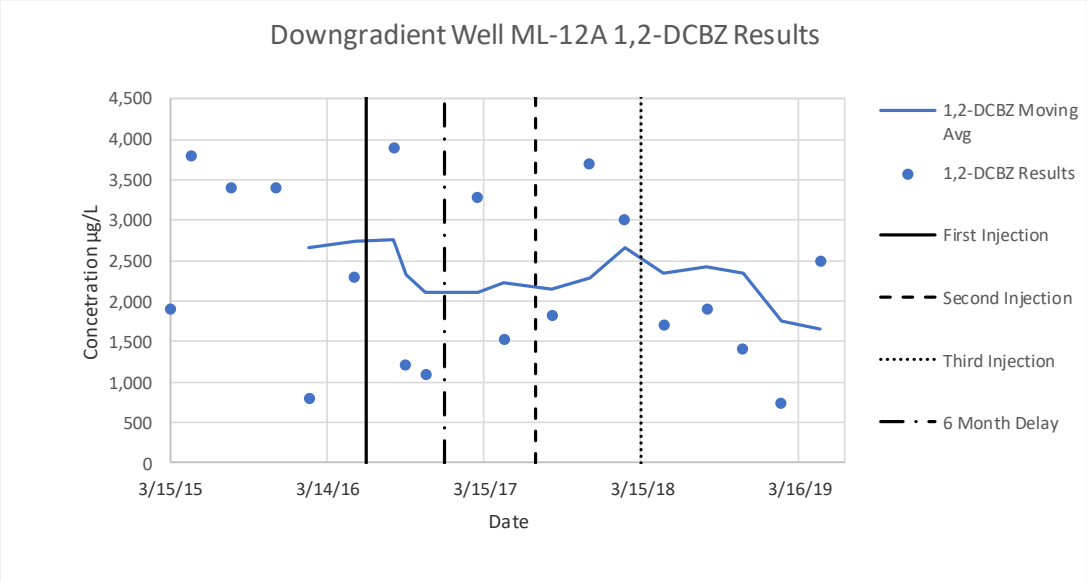

Figure 12: 1,2-Dichlorobenzene Results in ML-12A

ML-12B is screened at elevation 279.6 to 300.6 (i.e. 174 feet to 153 feet bgs). This well screen is considered to be hydraulically connected to the borehole in ML-11. Prior to the injection, the concentration of 1,2-dichlorobenzene in ML-12B ranged from approximately 20 µg/L to 400 µg/L. The concentration of Chlorobenzene ranged from approximately 800 µg/L to 6,000 µg/L. The concentrations of 1,2-dichlorobenzene and Chlorobenzene appear to decrease relative to pre-injection levels in October 2016 four (4) months after the first injection, and then appear to rebound in August and November 2017. Since the completion of the third injection the concentration of 1,2-dichlorobenzene in ML-12B has ranged from 22 µg/L to 110 µg/L, and the concentration of chlorobenzene has ranged from 130 µg/L to 3,100 µg/L.

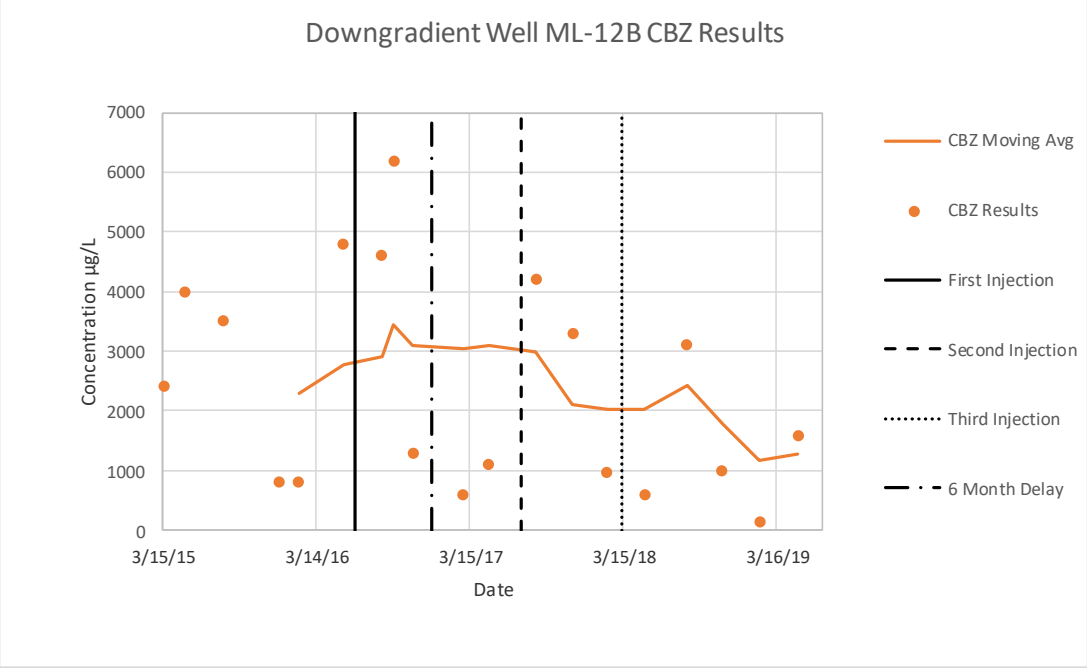

Figure 13: Chlorobenzene Results in ML-12B

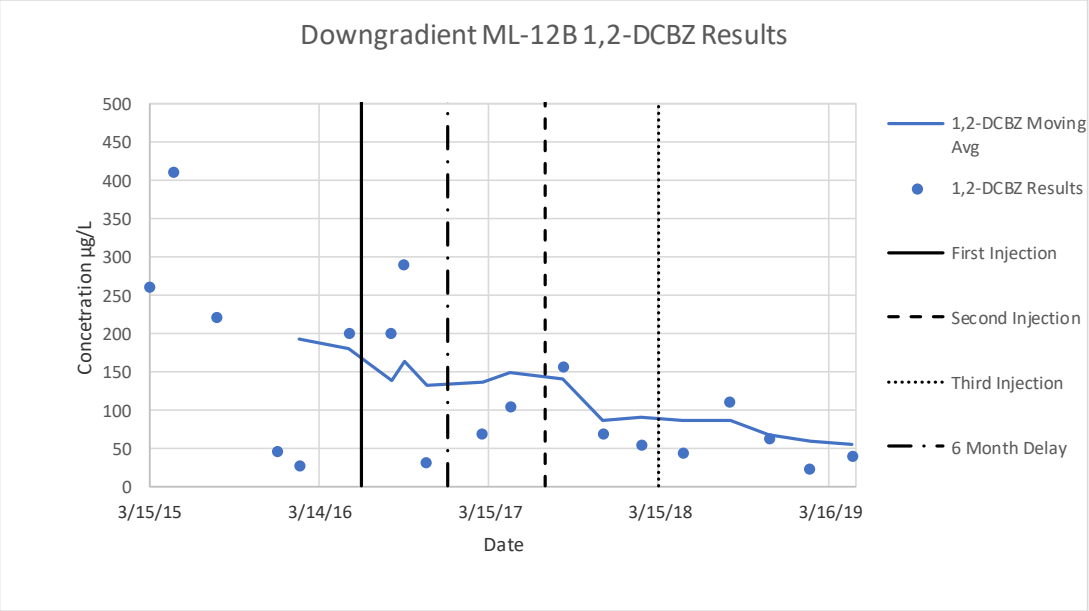

Figure 14: 1,2-Dichlorobenzene Results in ML-12B

ML-12C is screened from elevation 235.6 to 245.6 (i.e. 218 feet to 208 feet bgs). This well screen is considered to be hydraulically connected to the borehole in ML-11. The concentration of 1,2-dichlorobenzene ranged from approximately 20 µg/L to 60 µg/L, prior to the injection. The concentration of Chlorobenzene ranged from approximately 20 µg/L to 1,110 µg/L, prior to the injection. Similar to ML-12B the concentrations of 1,2-dichlorobenzene and chlorobenzene appear to decrease relative to pre-injection levels in October 2016 and rebound in November 2017. The results for 1,2-dichlorobenzene and chlorobenzene in ML-12C have been below the action levels since November 2018.

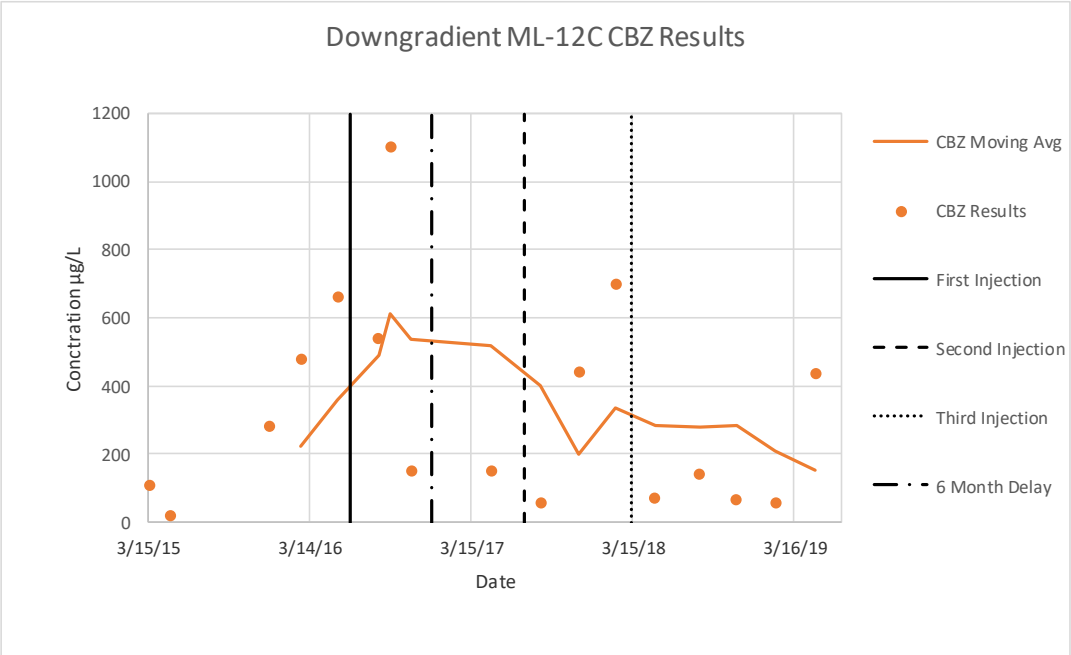

Figure 15: Chlorobenzene Results in ML-12C

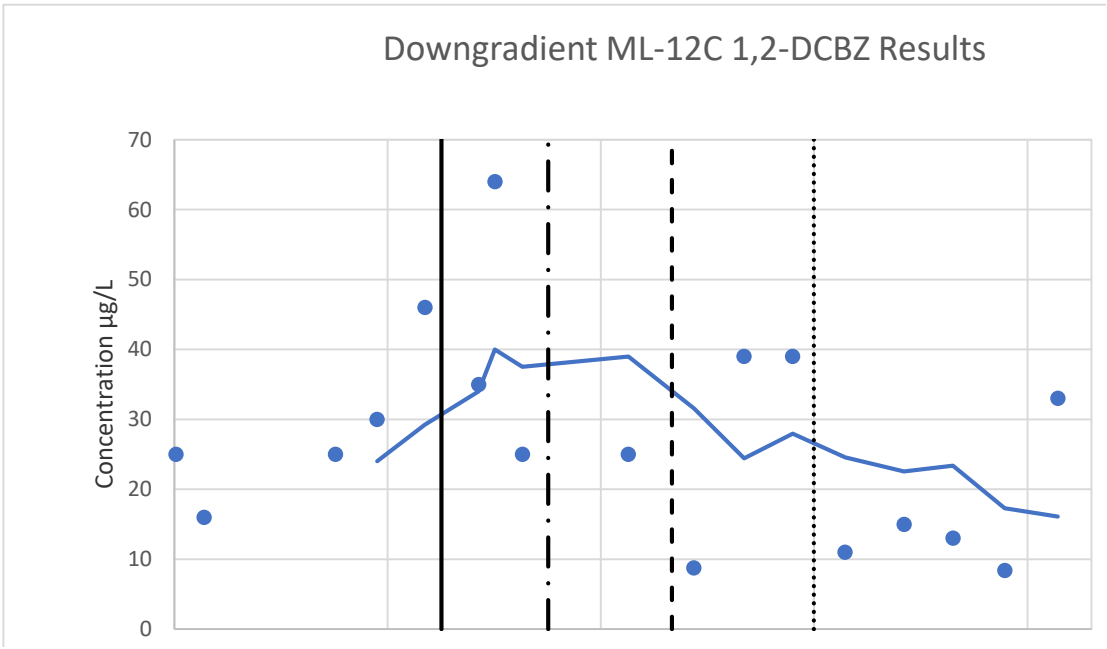

Figure 16: 1,2-Dichlorobenzene Results in ML-12C

ML-12D is screened from elevation 209.6 to 222.6 (i.e. 244 feet to 213 feet bgs). This well screen is considered to be hydraulically connected to the borehole in ML-11. The concentration of 1,2-dichlorobenzene prior to the injection ranged from approximately 40 µg/L to 160 µg/L. The concentration of chlorobenzene prior to the injection ranged from approximately 500 µg/L to 1,000 µg/L. The concentration of 1,2-dichlorobenzene and chlorobenzene appear to decrease relative to pre-injection levels in March 2017, seven (7) months after the first injection and have stayed consistently lower until the February 2019 sampling round. The increase in the concentration of contaminants in ML-12C since the February 2019 sampling round may indicate that the portion of the PlumeStop barrier that is hydraulically connected to ML-12C is saturated with contaminants and break through is occurring.

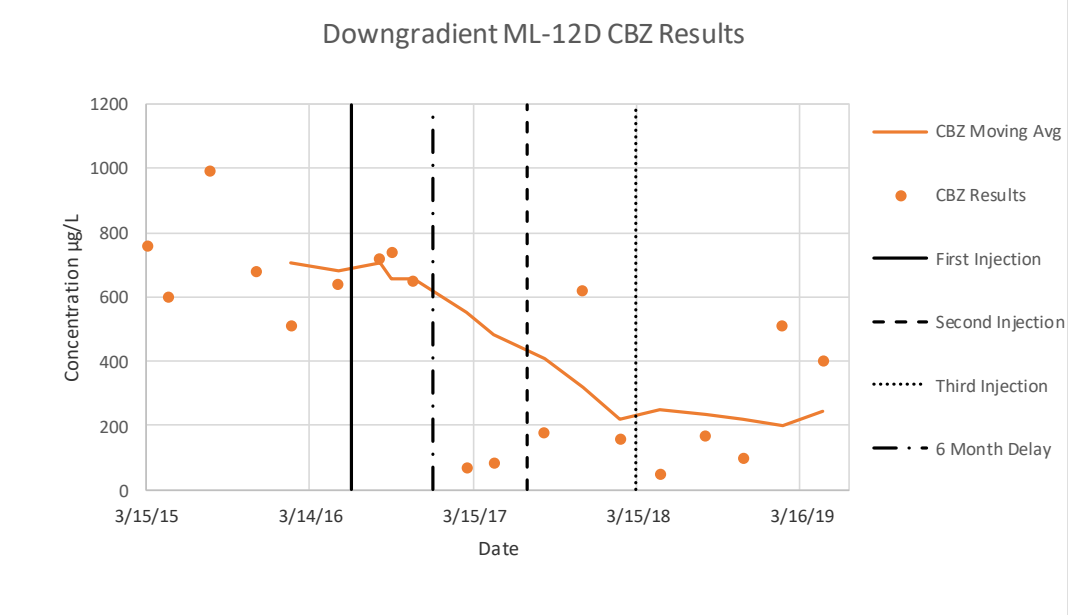

Figure 17: Chlorobenzene Results in ML-12D

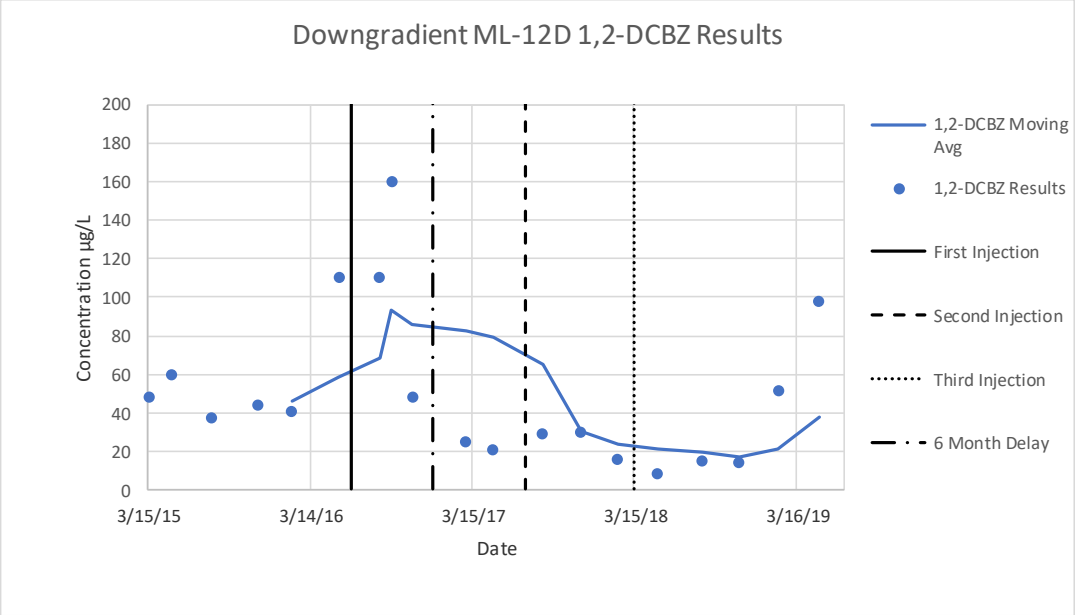

Figure 18: 1,2-Dichlorobenzene Results in ML-12D

ML-12E is screened from 148.6 to 158.6 (i.e. 305 feet to 295 feet bgs). The decrease in contaminant levels was not observed in samples from ML-12E (the deepest well screen). As depicted in Figure 4, this section of well screen is located at a deeper elevation than the bottom of ML-11. It is likely that the PlumeStop injected into ML-11 did not reach the deeper bedrock fractures, therefore, treatment of the deeper bedrock contamination did not occur.

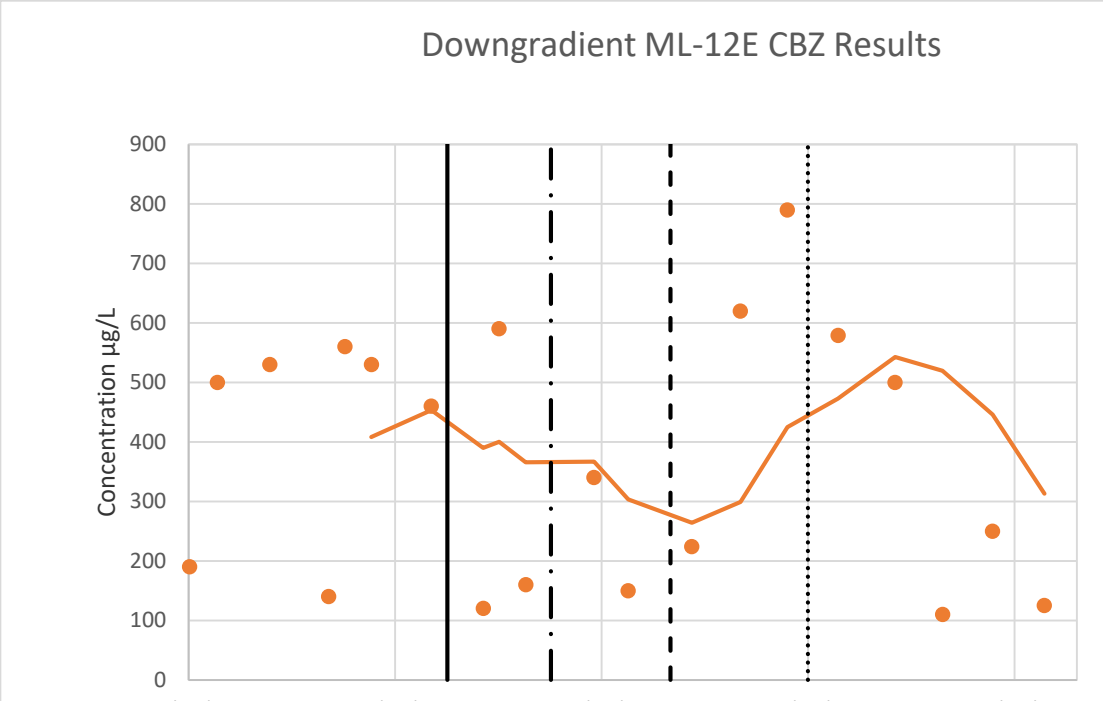

Figure 19: Chlorobenzene Results in ML-12E

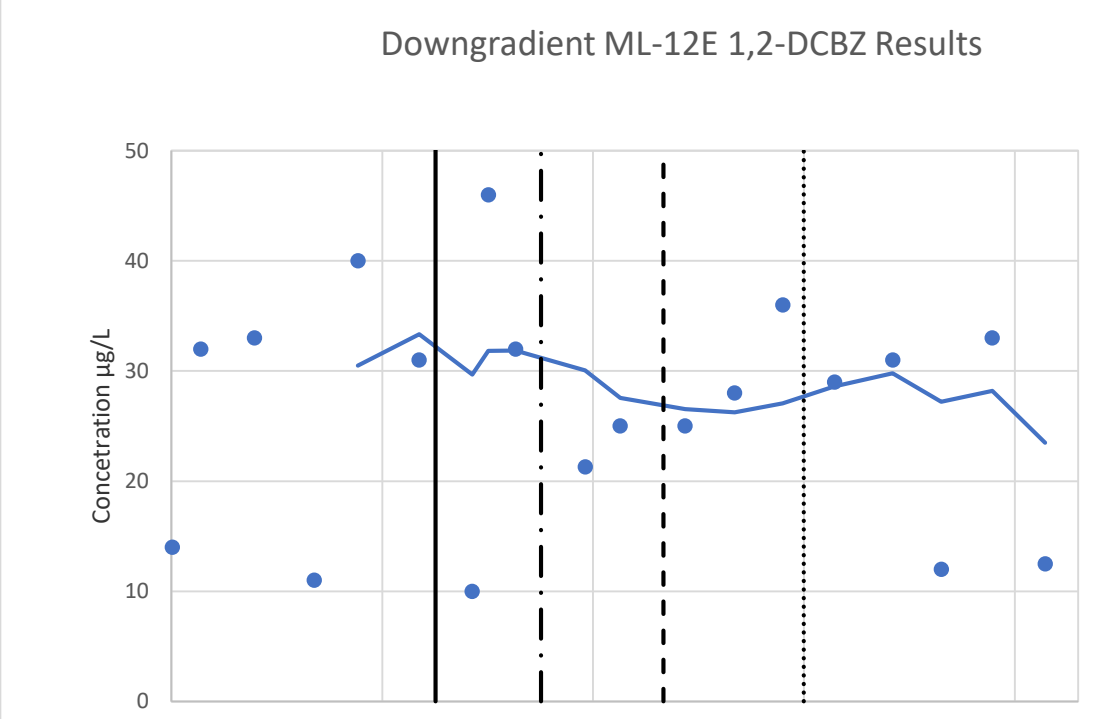

Figure 20: 1,2-Dichlorobenzene Results in ML-12E

Central Landfill Statistical Analysis

A t-test analysis was performed to compare pre and post injection data for 1,2-dichlorobenzene and chlorobenzene in ML-11 and ML-12. For ML-11 the pre and post injection data was separated based on the date of the first injection. For ML-12 pre and post injection data was separated based on a 6-month delay (assumed 6 months due to the 3 to 9-month range of the expected delay) from the date of the first injection.

Eight (8) samples have been collected from ML-11 since the first injection, so the t-test compared the eight (8) sample results pre and post the injection. Accounting for a 6-month delay there have been ten (10) post injection sampling events and nine (9) pre-injection sampling events. The p-values from the t-test are presented in Table 1.

Table 1: Central Landfill t-test p-values for Pre and Post Injection Data Comparison

	ML-11	ML-12A	ML-12B	ML-12C	ML-12D	ML-12E
1,2-DCBZ	2.99E-05	6.01E-01	1.72E-02	1.01E-01	1.81E-02	3.63E-01
CBZ	7.77E-02	8.76E-01	6.65E-02	2.26E-01	1.97E-05	9.26E-01

Based on t-test using 90% confidence ($p = 0.1$), there is a statistically significant difference between the pre and post injection results for 1,2-dichlorobenzene in ML-11, ML-12B, ML-12C, and ML-12D, but not ML-12A or ML-12E. There is a statistically significant difference between the pre and post injection results for chlorobenzene in ML-11, ML-12B, and ML-12D but not for ML-12A, ML-12C, or ML-12E.

Former Plating Facility

A comparison of the August 2011 baseline to the March 2019 field-screening parameters and laboratory results show that there have been changes in the distribution and character of contaminant concentrations and aquifer conditions within the identified zone of contamination, refer to attached Tables 7 through 16. As described above, the site source area was treated with an injection of a ZVI-organic carbon emulsion. The wells downgradient of the source area began to show signs of rebound beginning in late 2013/early 2014. Generally, the concentration of contaminants downgradient of the injections appear to have decreased since the injection. The initial reduction in contaminant concentrations may be the result of dilution, refer to Appendix B for an evaluation of dilution as a result of the injections.

GZ-3 Results

During the first sampling event after the injection, activated carbon particles were observed in GZ-3. The appearance of PlumeStop in GZ-3 after the injection may be an indication that the PlumeStop has migrated past GZ-3. The concentration of contaminants in GZ-3 decreased initially, but appears to show signs of rebound. This rebound may be occurring because the injectate has migrated downgradient of GZ-3, therefore the results are reflective of the source area without treatment. Alternatively, the increase may be because the PlumeStop in the vicinity of GZ-3 is saturated with contaminants. Note, that GZ-3 has historically shown contaminant concentrations reflective of the source area at the Site. As shown in Figure 21, the TCE is the predominant contaminant in GZ-3. The results for PCE, TCE, DCE, and VC in GZ-3 are still in exceedance of action levels.

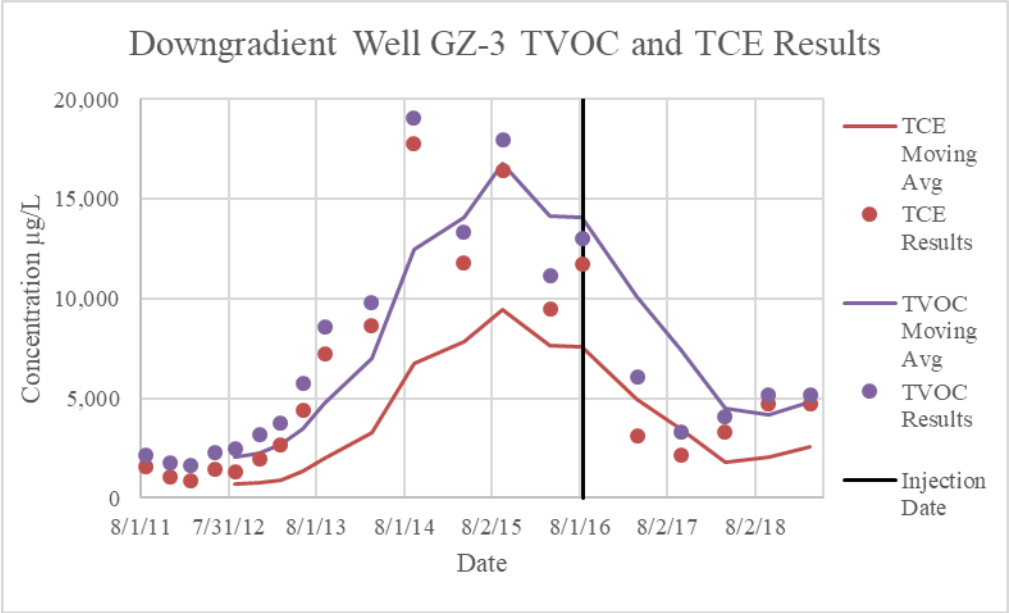

Figure 21: Downgradient Well GZ-3 TVOC and TCE Results

The results for PCE in GZ-3 shown in Figure 22 also show an initial reduction in contaminant concentrations and then possible rebound. As described earlier it is unclear whether this rebound is the result of saturation of the PlumeStop, or because the PlumeStop has migrated downgradient of GZ-3.

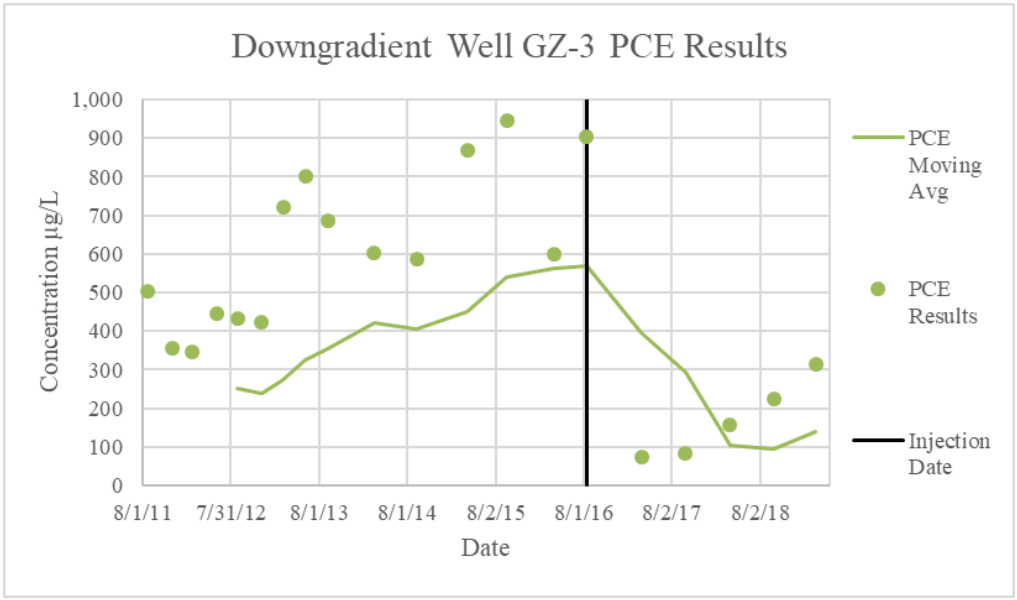

Figure 22: Downgradient Well GZ-3 PCE Results

As shown in Figure 23, DCE increases immediately after the injection. TCE is the predominant contaminant in GZ-3. TCE degrades into DCE as a result of reductive dechlorination. The increase in DCE therefore, may the result of degradation of TCE. As described earlier, the TCE and PCE concentrations appear to rebound which may be the result of the PlumeStop migrating past GZ-3. The increase in TCE and PCE appears to correspond with a decrease in DCE concentrations, further indicating that GZ-3 may not be benefitting from the injections because the PlumeStop is downgradient of the well. If the PlumeStop is downgradient of GZ-3, then the decrease in DCE cannot be the result of the PlumeStop treatment, but rather a lack of biodegradation.

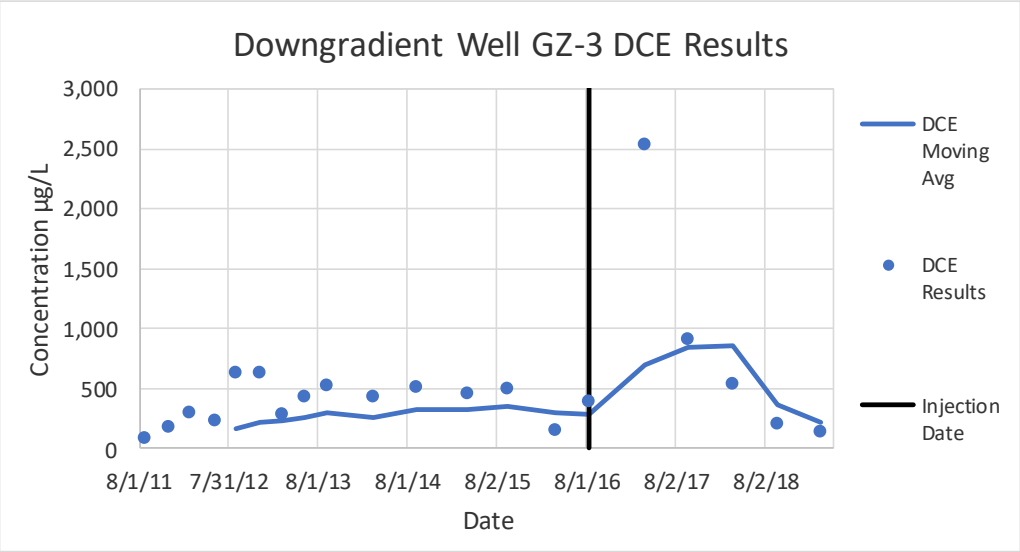

Figure 23:Downgradient Well GZ-3 DCE Results

The results for VC shown in Figure 24 appear to be decreasing. As indicated above this decrease may be indicating that biodegradation is not occurring because the

PlumeStop is downgradient of GZ-3.

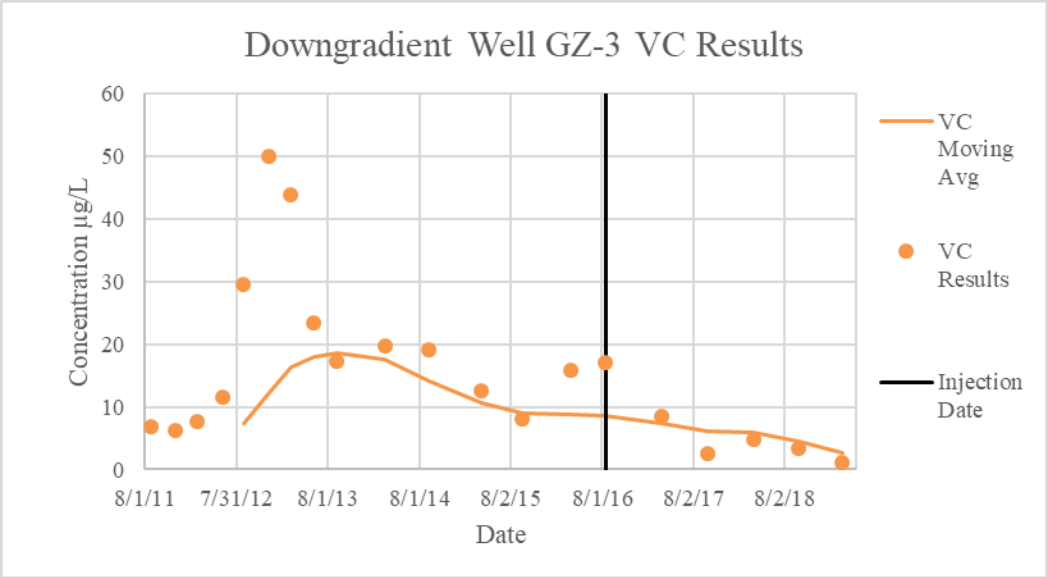

Figure 24: Downgradient Well GZ-3 VC Results

GZ-4 Results

VC results for GZ-4 are not presented because all of the results for VC to date have been below the method detection limit (i.e. non-detect). As shown in Figure 25 TCE is the predominant contaminant found in GZ-4. As shown on Figures 25 to 27, the concentrations of TVOCs, PCE, TCE and DCE all appear to have decreased since the injection. The results for PCE, TCE, DCE, and VC have all been below the action levels for the last five sampling rounds with the exception of the TCE result in September 2017. There is no evidence that biodegradation of contaminants is occurring because there is no increase in degradation products corresponding to a decrease in parent compounds. This lack of degradation products may be because biodegradation is not occurring, alternatively this may be because the degradation products remain adsorbed to the PlumeStop surface.

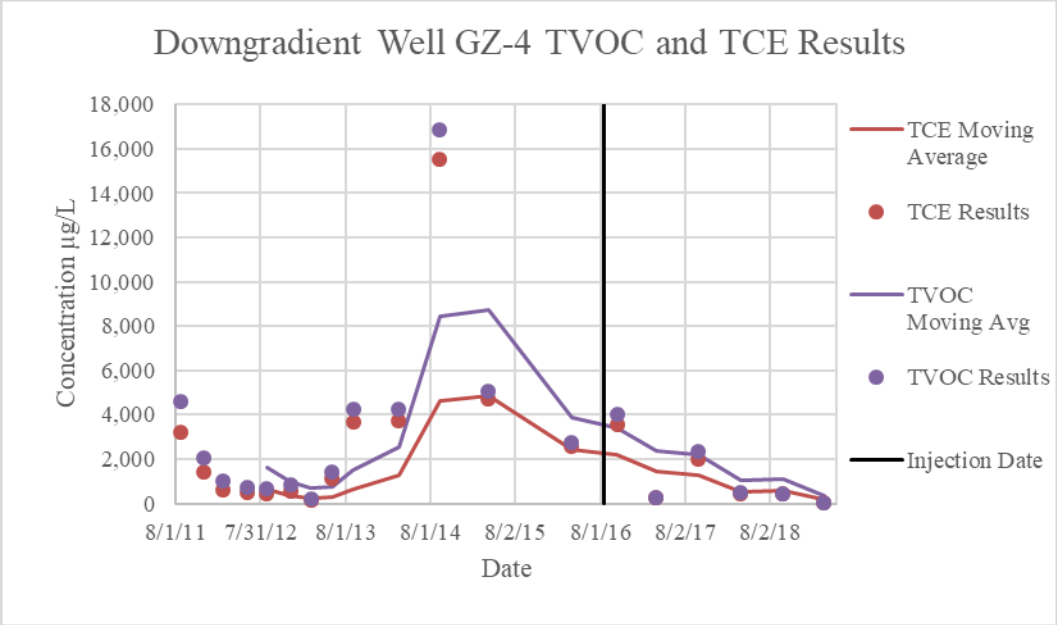

Figure 25: Downgradient Well GZ-4 TVOC and TCE Results

The PCE results in GZ-4 appear to have decreased since the injection. The results for PCE have been below action levels since the February 2012 sampling round (before the injection).

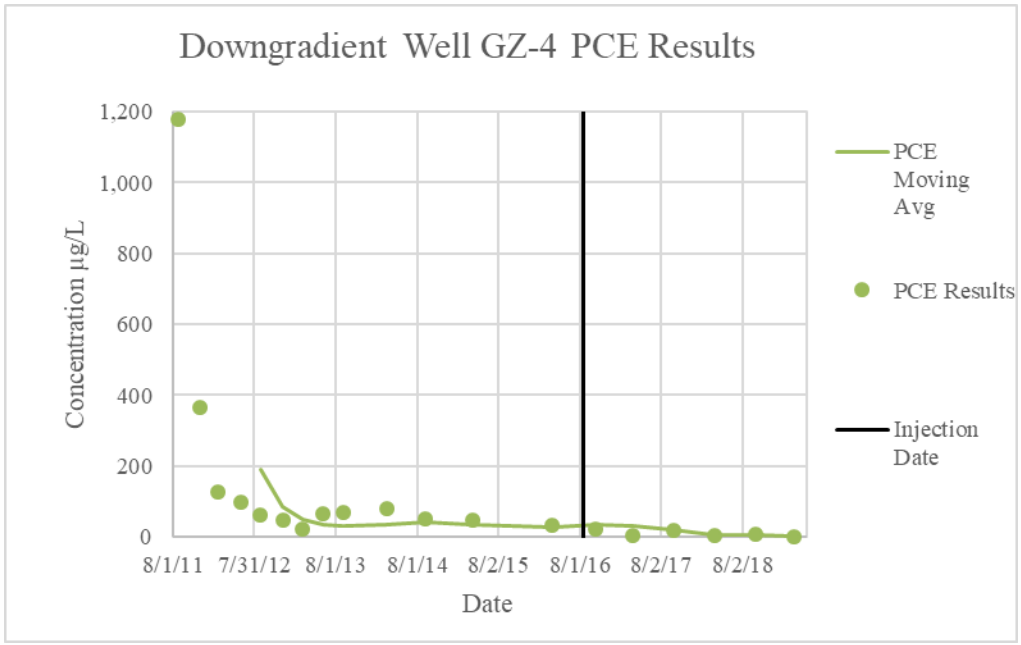

Figure 26: Downgradient Well GZ-4 PCE Results

The DCE results in GZ-4 also appear to have decreased since the injection.

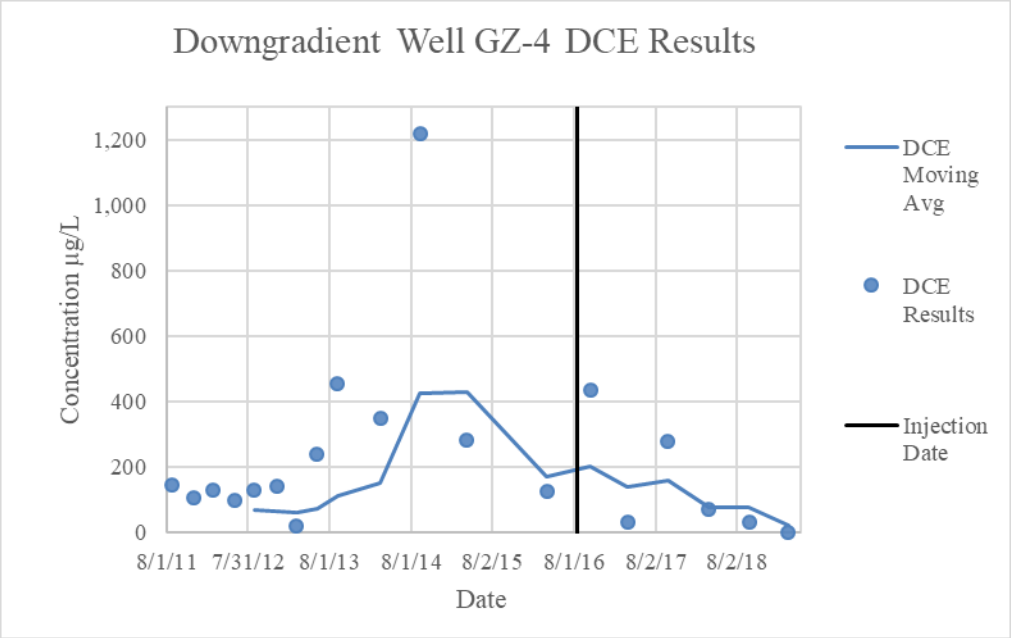

Figure 27: Downgradient Well GZ-4 DCE Results

GZ-5 Results

TCE is also the predominant contaminant in GZ-5. As shown in Figure 28, the concentrations of TVOCs and TCE have decreased since the injection. The results for TVOCs, PCE, TCE and DCE have all been below actions levels for the last five sample rounds. VC has also been below action levels since the injection with the expection of the September 2018 sampling round.

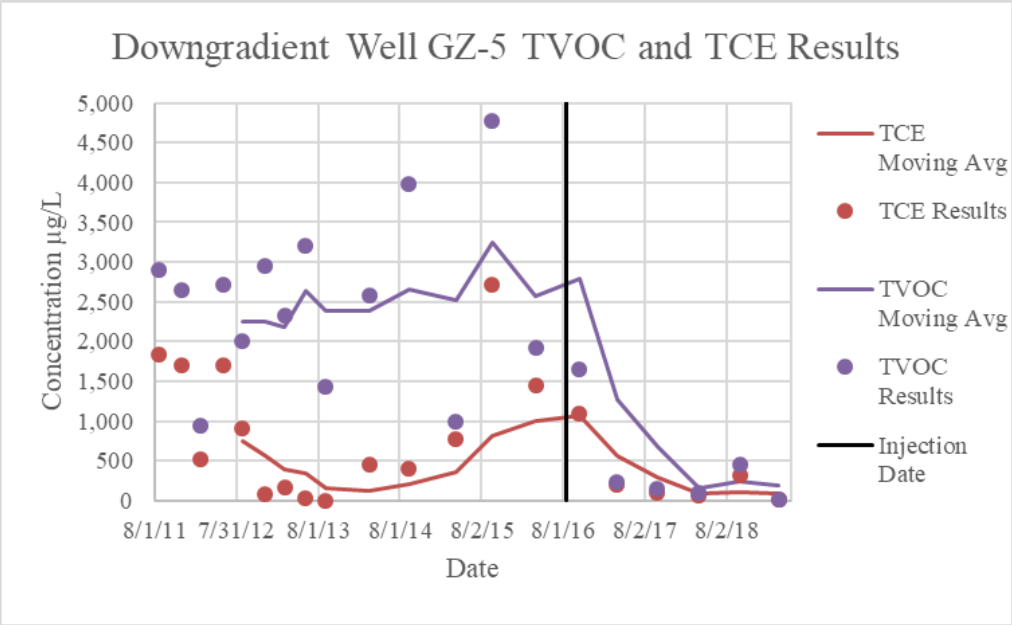

Figure 28:Downgradient Well GZ-5 TVOC and TCE Results

Figure 29 depicts the results for PCE in downgradient well GZ-5. The results for PCE appear to have decreased since the injection.

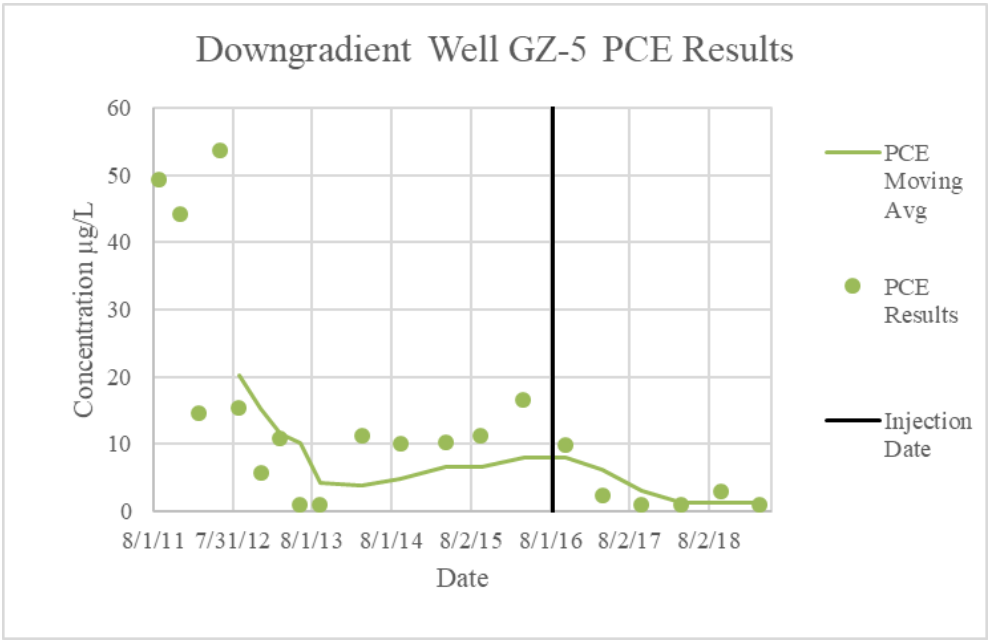

Figure 29: Downgradient Well GZ-5 PCE Results

As shown in Figure 30, the results for DCE in GZ-5 also appear to have decreased since the injection. DCE degrades to VC. Figure 31 shows a sharp increase in VC concentration after the injection, which may be the result of DCE degradation. However, as previously described it is unclear whether degradation products remain adsorbed to the PlumeStop surface.

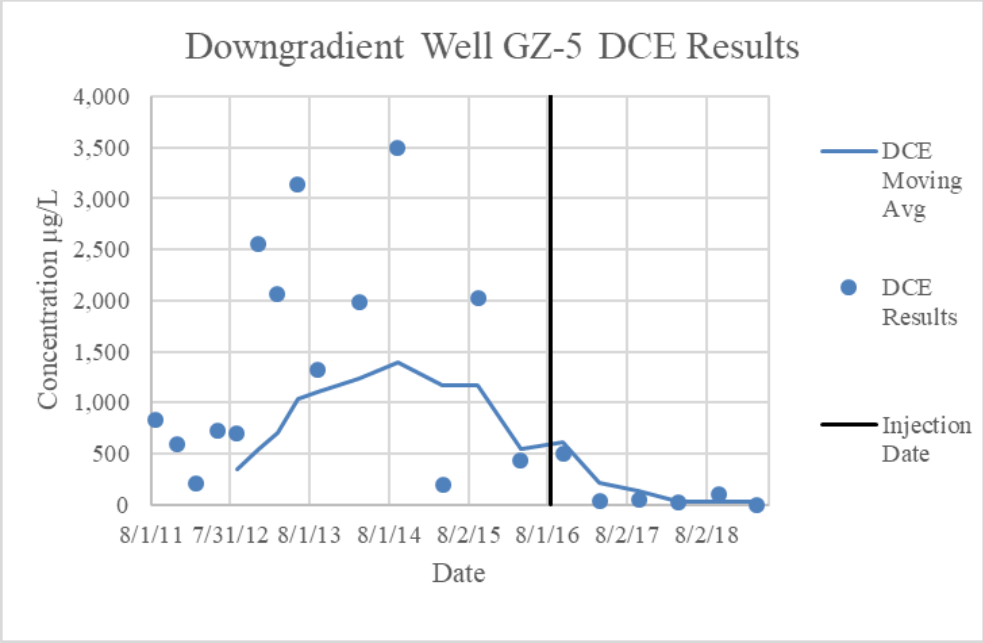

Figure 30:Downgradient Well GZ-5 DCE Results

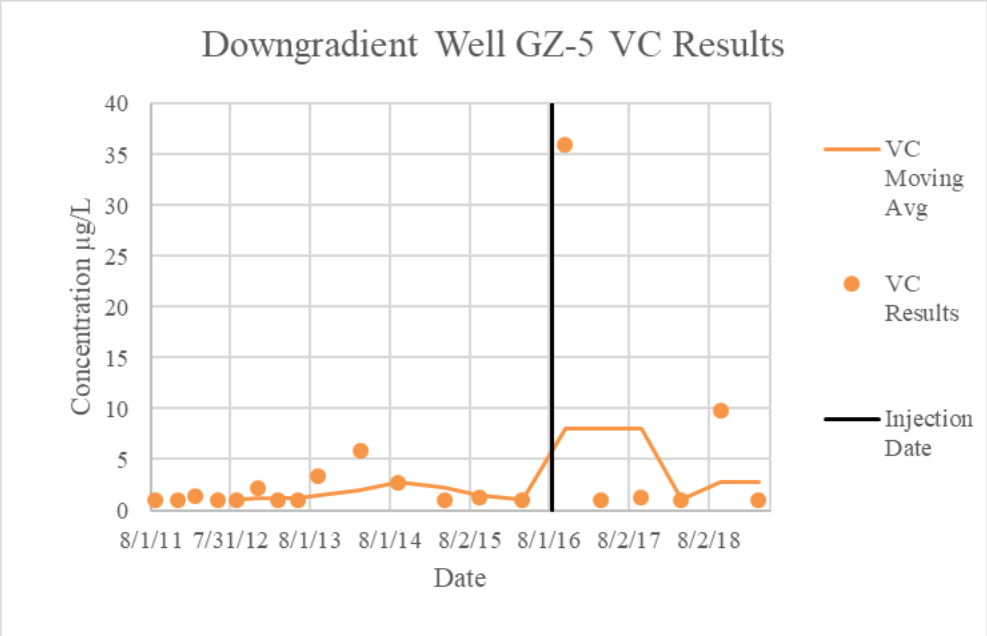

Figure 31: Downgradient well GZ-5 VC Results

MW-2D Results

As shown in Figure 32, DCE is the predominant contaminant found in MW-2D. VC results for MW-2D are not presented because all of the results for VC to date have been below the method detection limit (i.e. non-detect). The concentration of DCE and TVOCs initially increases after the injections. There is not enough TCE observed in MW-2D to account for the increase in DCE as a result of degradation. The increase may be the result of mobilizing a pocket of contamination as a result of the injections. After the initial spike in DCE and TVOC concentrations, the concentration of both DCE and TVOCs appear to decrease.

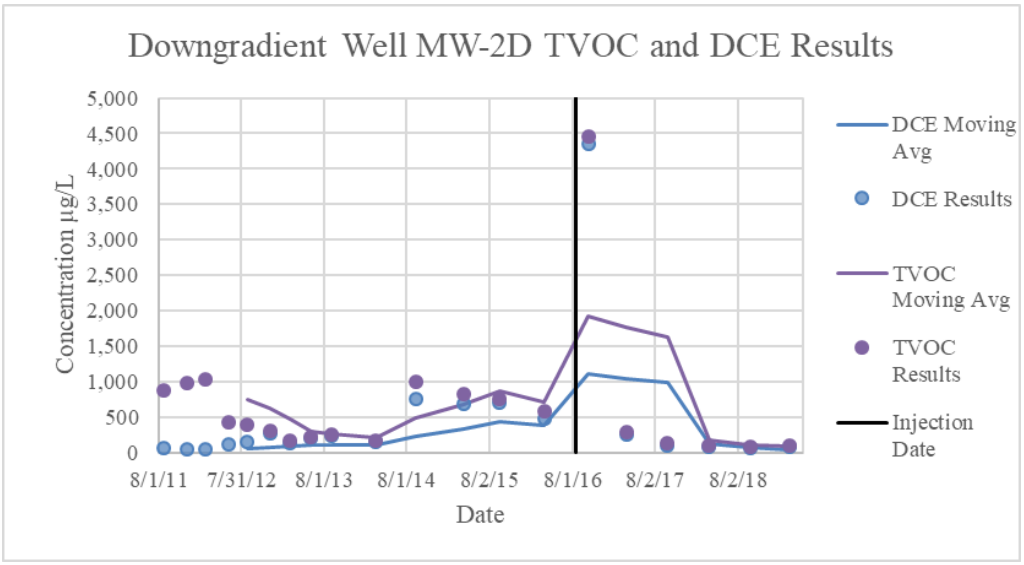

Figure 32: Downgradient Well MW-2D TVOC and DCE Results

The results for PCE and TCE in MW-2D (shown in Figures 33 and 34, respectively) appear to have decreased since the injection. The results for PCE, TCE, and DCE have all been below action levels for the last five sampling rounds.

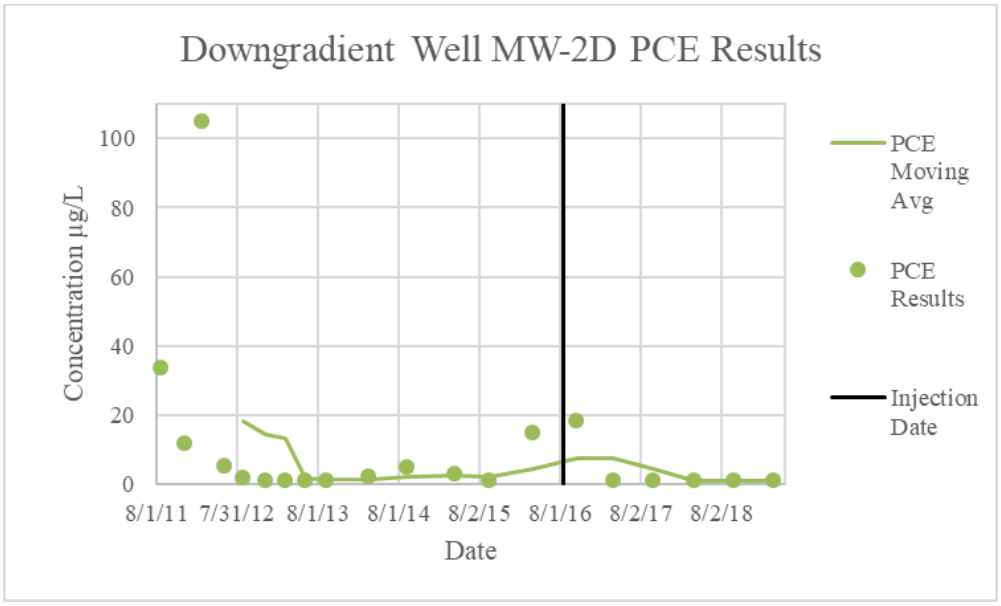

Figure 33: Downgradient Well MW-2D PCE Results

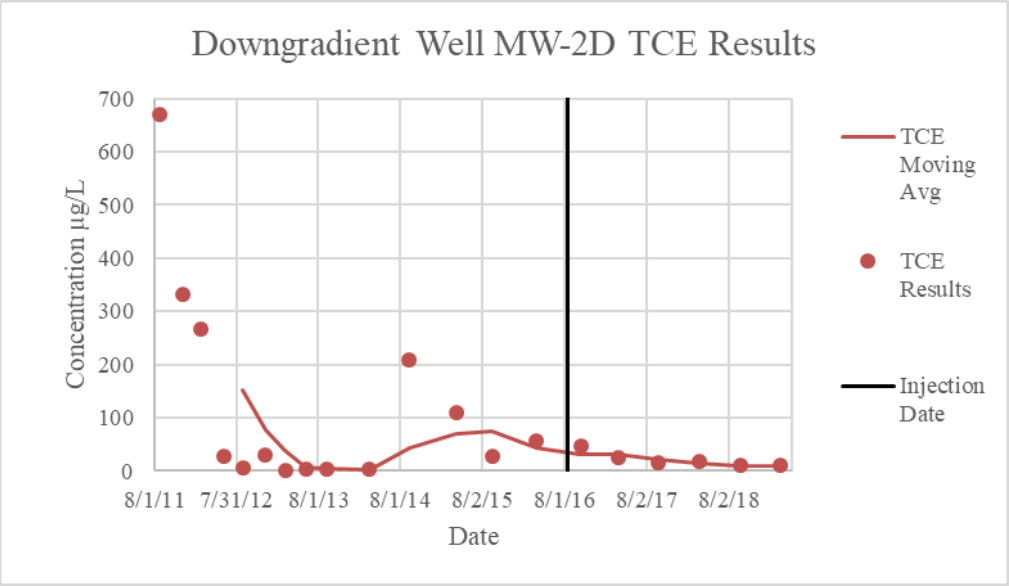

Figure 34: Downgradient Well MW-2D TCE Results

GZ-6 Results

Downgradient well GZ-6 is the furthest from the injection points. We expect to see a delay of approximately 12 to 14 months for groundwater to travel from the PRB injection area to GZ-6. As shown in Figure 35, TCE is the predominant contaminant observed in GZ-6. Based on the results thusfar, it appears as though the concentrations of PCE, TCE, DCE, and VC in GZ-6 are beginning to decrease. As shown in Figure 36, the results for PCE have been decreasing since 2011, which may be a result of the ZVI treatment in addition to the PlumeStop treatment. Figure 37, depicts a sharp decrease in DCE concentrations during the latest sampling round. As shown in Figure 38, the VC was beginning to increase and then decreased, due to the delay it appears that this increase and decrease is related to the ZVI treatment and not the PlumeStop treatment. Long-term monitoring will be required to determine if the PlumeStop injections effectively reduce offsite migration of contaminants.

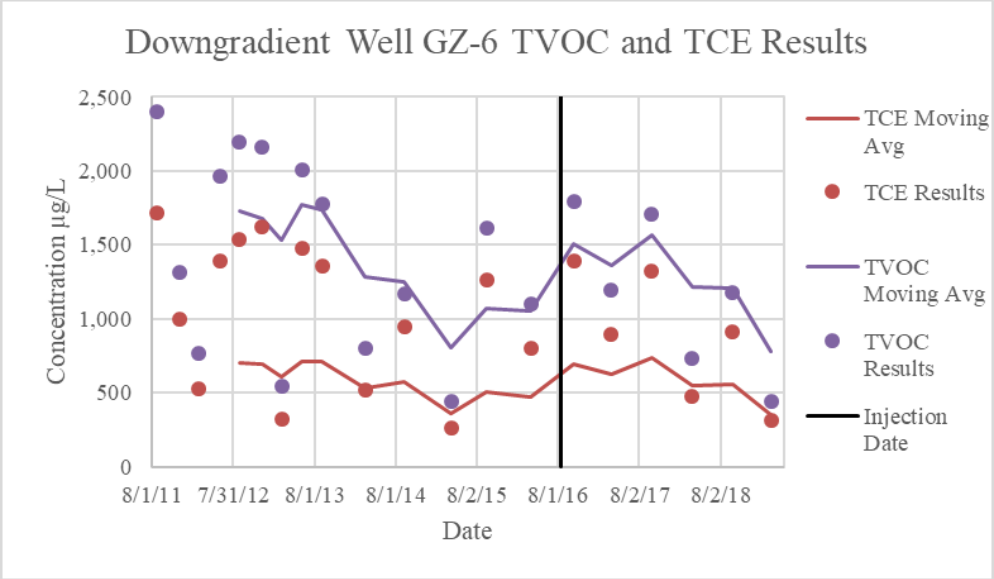

Figure 35: Downgradient Well GZ-6 TVOC and TCE Results

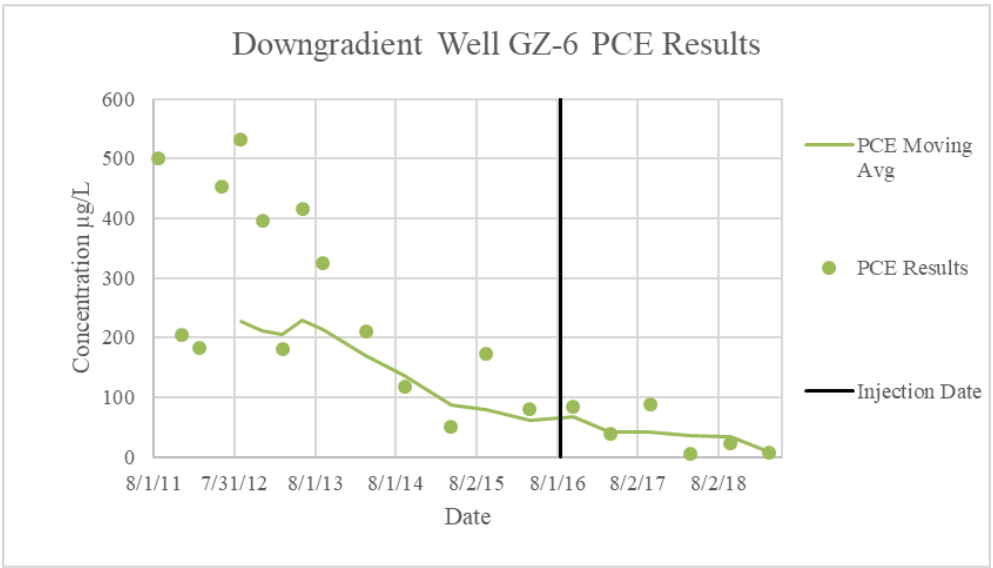

Figure 36: Downgradient Well GZ-6 PCE Results

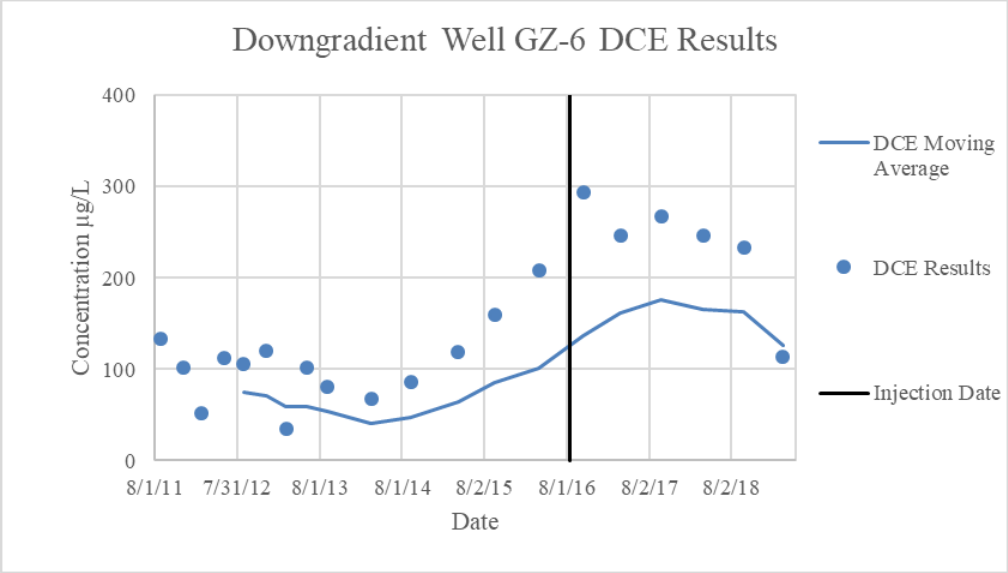

Figure 37: Downgradient Well GZ-6 DCE Results

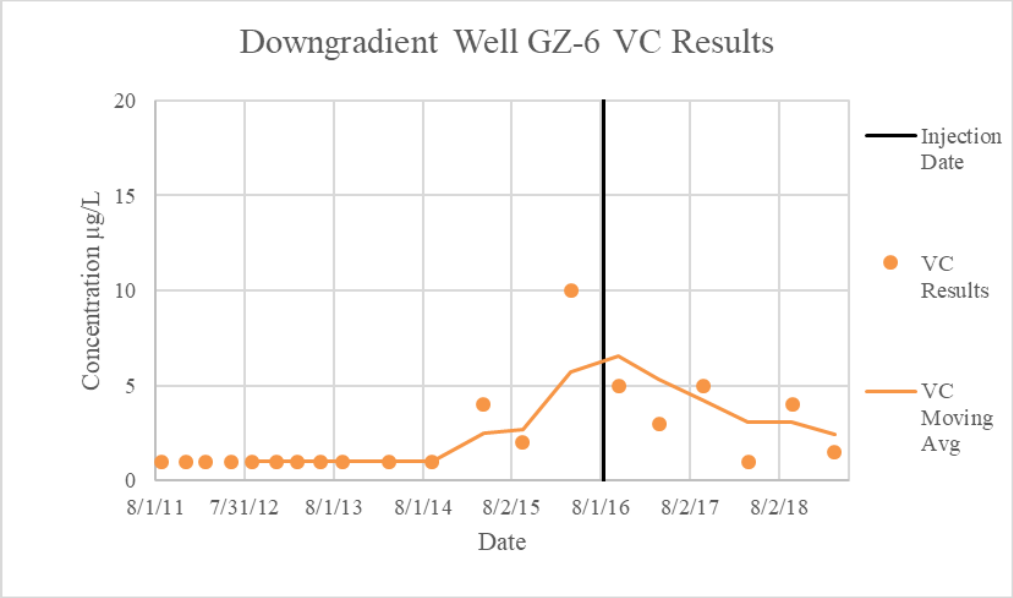

Figure 38: Downgradient Well GZ-6 VC Results

Former Plating Facility Statistical Analysis

A t-test was performed for the sampling results from GZ-3, GZ-4, GZ-5 and MW-2D. A t-test was not performed for GZ-6. As described previously there is a delay of 12-14 months between the time of the injection, and when the impacts of the injection

are expected to appear in GZ-6. As a result of that delay only three (3) samples have been collected that reflect the impact of the treatment in GZ-6. With only three (3) data points the results of a t-test would not be valid.

For GZ-3, GZ-4, GZ-5, and MW-2D six (6) samples have been collected since the injection. The t-test was performed with the six (6) data points points pre and post injection for the TVOC, PCE, TCE, DCE, and VC results.. The resulting p-values are presented in Table X. The results for VC were non-detect for GZ-4 and MW-2D, therefore, a t-test was not performed for these results.

Table 2: Former Plating Facility t-test p-values for Pre and Post Injection Data Comparison

	GZ-3	GZ-4	GZ-5	MW-2D
TVOC	2.24E-04	8.78E-02	7.73E-03	7.32E-01
PCE	1.37E-04	1.08E-04	1.79E-02	8.69E-01
TCE	3.25E-04	9.03E-02	1.54E-01	1.86E-01
DCE	3.29E-01	1.16E-01	1.58E-02	6.65E-01
VC	1.88E-03	NA	3.37E-01	NA

Based on t-test using 90% confidence ($p = 0.1$), there is a statistically significant difference between the pre and post injection results for TVOC, PCE, TCE, and VC in GZ-3. There is a statistically significant difference between the pre and post injection results for TVOC, PCE, and TCE in GZ-4. There is a statistically signficant difference between the pre and post injection results for TVOC, PCE, and DCE in GZ-5. There was not a statistically significant difference between the pre and post injection results for MW-2D.

CHAPTER 5

CONCLUSION

The results indicate that PlumeStop injection at the Central Landfill successfully reduced contaminant levels in the source area well and provided some reduction of contaminants in the downgradient well. Additionally, the two formulations of PlumeStop appear to have behaved as expected and fall out of suspension at different times and flow longer and shorter distances based on the different formulations. It is still unclear why the submersible pumps used during the injection in ML-11 failed. There appears to be some interference from the PlumeStop that affects the submersible pumps. As described above, the injection into upgradient well MW56 failed to infiltrate into the bedrock. This well was not developed prior to the injection which may have contributed to the injectate not infiltrating. Additionally, MW56 only extends into the shallow bedrock which may have contributed to the low infiltration rate.

The groundwater at Central Landfill contains many more contaminants of concern than those discussed in this paper. Some of these contaminants may interfere with the performance of PlumeStop.

The injection at the former plating facility also appears to have successfully reduced contaminant levels in the wells downgradient of the PRB. Some of the results are still in exceedance of regulatory limits. During the injection, the injectate appeared in two of the downgradient wells. The placement of the injection points should be

from enough from the wells that the PlumeStop does not appear in the wells. Most of the injection points for the Former Plating Facility were placed far enough away to not impact nearby wells, with the exception of IP-10. After the injection, PlumeStop appeared in monitoring well GZ-3. The PlumeStop observed in GZ-3 was agglomerating together, therefore, it appears that the coating on the PlumeStop particles degraded at the same time the injectate was flowing into the vicinity of GZ-3 and fell out of suspension in the well. Planning the injection points to avoid issues with the PlumeStop appearing in monitoring wells is clearly an important part of designing the PRB.

The long-term effectiveness of the injectate remains to be seen. GZA will continue to monitor the groundwater quality downgradient of the injections to evaluate breakthrough of the PRB.

CHAPTER 6

RECOMMENDATIONS

Prior to performing future injections with PlumeStop it is recommended to perform bench scale tests of the product using the actual groundwater and soils from the site of interest. The bench scale testing will evaluate the performance of the product in an environment that is easily monitored. This would help define the quantity of PlumeStop required to achieve the project specific goals

Understanding the hydraulic conductivity of the site is also important to planning the injections. Tracer tests may also be helpful in evaluating/anticipating the flow paths that the PlumeStop will follow.

APPENDICES

Appendix A – Tables 3 through 18

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11													
			1/7/15		2/13/15		3/5/15		4/2/15		5/12/15		6/16/15		7/9/15	
			RESULTS		RESULTS		RESULTS		RESULTS		RESULTS		RESULTS		RESULTS	
1,1,1-Trichloroethane	200	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,1,2-Tetrachloroethane	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,1-Dichloroethane	2.4[6]	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100
1,1-Dichloroethene	7	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2,4-Trichlorobenzene	70	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dibromoethane	0.05	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dichlorobenzene	600	ug/l		**16,000**		**15,000**		**12,000**		**12,000**		**9,300**		**13,000**		**10,000**
1,2-Dichloroethane	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dichloropropane	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,3-Dichlorobenzene	600	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,4-Dichlorobenzene	75	ug/l		**520**		**510**	<	500	<	500	<	500	<	500	<	500
1,4-Dioxane	-	ug/l		**880**	<	500	<	500	<	500		**850**	<	500	<	500
2-Butanone (MEK)	4,000[6]	ug/l		NT		NT		NT		NT		NT		NT		NT
Benzene	5	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100
Carbon Tetrachloride	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Chlorobenzene	100	ug/l		**5,800**		**6,000**		**5,900**		**6,100**		**6,100**		**6,300**		**2,000**
cis-1,2-Dichloroethene	70	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Ethylbenzene	700	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Naphthalene	100[6]	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Tetrachloroethene	5	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100
trans-1,2-Dichloroethene	100	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Trichloroethene	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Vinyl chloride	2	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11													
			8/3/15		9/1/15		10/5/15		11/2/15		12/2/15		1/6/16		2/3/16	
			RESULTS		RESULTS		RESULTS		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,1,2-Tetrachloroethane	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,1-Dichloroethane	2.4[6]	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100
1,1-Dichloroethene	7	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2,4-Trichlorobenzene	70	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dibromoethane	0.05	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dichlorobenzene	600	ug/l		**12,000**		**17,000**		**16,000**		**10,000**		**12,000**		**12,000**		**14,000**
1,2-Dichloroethane	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,2-Dichloropropane	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,3-Dichlorobenzene	600	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
1,4-Dichlorobenzene	75	ug/l		**300**	<	500		**550**	<	500	<	500	<	500	<	500
1,4-Dioxane	-	ug/l	<	500	<	500	<	500	<	500		**1,000**		**1,400**		**1,600**
2-Butanone (MEK)	4,000[6]	ug/l		NT		NT		NT	<	500	<	500	<	500	<	500
Benzene	5	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100
Carbon Tetrachloride	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Chlorobenzene	100	ug/l		**5,700**		**5,200**		**7,200**		**1,700**		**2,700**		**4,600**		**6,600**
cis-1,2-Dichloroethene	70	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Ethylbenzene	700	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Naphthalene	100[6]	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Tetrachloroethene	5	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100
trans-1,2-Dichloroethene	100	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Trichloroethene	5	ug/l	<	500	<	500	<	500	<	500	<	500	<	500	<	500
Vinyl chloride	2	ug/l	<	100	<	100	<	100	<	100	<	100	<	100	<	100

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11													
			3/4/16		4/1/16		8/17/16		9/16/16		10/31/16		3/3/17		5/10/17	
			RESULT		RESULT		RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,1,2-Tetrachloroethane	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,1-Dichloroethane	2.4[6]	ug/l	<	100	<	100		**17**		**21**	<	80	<	40		**13.3**
1,1-Dichloroethene	7	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2,4-Trichlorobenzene	70	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dibromoethane	0.05	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dichlorobenzene	600	ug/l		**11,000**		**14,000**		**1,100**		**1,900**		**13,000**		**2,830**		**2,190**
1,2-Dichloroethane	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,2-Dichloropropane	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,3-Dichlorobenzene	600	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
1,4-Dichlorobenzene	75	ug/l	<	500	<	500	<	50	<	100		**480**	<	200		**87.1**
1,4-Dioxane	-	ug/l	<	500	<	500		**3000**		**3100**	<	400		**2,520**		**2,660**
2-Butanone (MEK)	4,000[6]	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Benzene	5	ug/l	<	100	<	100		**43**		**59**	<	80		**70.8**		**54.4**
Carbon Tetrachloride	5	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Chlorobenzene	100	ug/l		**3,800**		**6,400**		**1,500**		**2,100**		**10,000**		**2,150**		**1,660**
cis-1,2-Dichloroethene	70	ug/l	<	500	<	500	<	50	<	100		**470**	<	200	<	50
Ethylbenzene	700	ug/l	<	500	<	500	<	50	<	100		**840**	<	200	<	50
Naphthalene	100[6]	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Tetrachloroethene	5	ug/l	<	100	<	100	<	10	<	20	<	80	<	40	<	10
trans-1,2-Dichloroethene	100	ug/l	<	500	<	500	<	50	<	100	<	400	<	200	<	50
Trichloroethene	5	ug/l	<	500	<	500	<	10	<	20		**160**	<	40	<	10
Vinyl chloride	2	ug/l	<	100	<	100	<	10	<	20		**150**	<	40	<	10

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 3: Central Landfill Groundwater Monitoring Results for MW03-ML11

Parameter	Action Level	UNIT	MW03-ML11					
			8/21/17		11/14/17		2/6/18	
			RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	200	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	200	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	40		**1.4**	<	1
1,1-Dichloroethene	7	ug/l	<	200	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	200	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	200	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	200	<	1	<	1
1,2-Dichlorobenzene	600	ug/l	<	200		**9.4**		**3.8**
1,2-Dichloroethane	5	ug/l	<	200	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	200	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	200	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	200	<	1	<	1
1,4-Dioxane	-	ug/l		**993**		**79**		**64**
2-Butanone (MEK)	4,000[6]	ug/l	<	200	<	5	<	5
Benzene	5	ug/l	<	40		**5.9**		**1.2**
Carbon Tetrachloride	5	ug/l	<	200	<	1	<	1
Chlorobenzene	100	ug/l	<	200		**48**		**5**
cis-1,2-Dichloroethene	70	ug/l	<	200	<	1	<	0.4
Ethylbenzene	700	ug/l	<	200	<	1	<	1
Naphthalene	100[6]	ug/l	<	200	<	1	<	1
Tetrachloroethene	5	ug/l	<	40	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	200	<	1	<	1
Trichloroethene	5	ug/l	<	40	<	1	<	1
Vinyl chloride	2	ug/l	<	40	R	0.5	<	0.5

Notes:

Open Borehole from elevation

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A									
			3/17/2015		5/5/2015		8/6/2015		11/17/2015		2/1/2016	
			RESULTS		RESULTS		RESULTS		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	50	<	120	<	100	<	100	<	40
1,1,2-Tetrachloroethane	5	ug/l	<	50	<	120	<	100	<	100	<	40
1,1-Dichloroethane	2.4[6]	ug/l	<	10	<	25	<	20	<	20	<	8
1,1-Dichloroethene	7	ug/l	<	50	<	120	<	100	<	100	<	40
1,2,4-Trichlorobenzene	70	ug/l	<	50	<	5	<	100	<	100	<	40
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	50	<	120	<	100	<	100	<	40
1,2-Dibromoethane	0.05	ug/l	<	50	<	120	<	100	<	100	<	40
1,2-Dichlorobenzene	600	ug/l		**1,900**		**3,800**	J	**3,400**		**3,400**		800
1,2-Dichloroethane	5	ug/l	<	50	<	120	<	100	<	100	<	40
1,2-Dichloropropane	5	ug/l	<	50	<	120	<	100	<	100	<	40
1,3-Dichlorobenzene	600	ug/l	<	50		**8.4**	<	100	<	100	<	40
1,4-Dichlorobenzene	75	ug/l		**110**		**210**		**180**		**150**		**40**
1,4-Dioxane	-	ug/l		**470**		**1,300**		**790**		**580**		**660**
2-Butanone (MEK)	4,000[6]	ug/l	<	50	<	120	<	100	<	100	<	40
Benzene	5	ug/l		**10**	<	25	<	20	<	20	<	8
Carbon Tetrachloride	5	ug/l	<	50	<	120	<	100	<	100	<	40
Chlorobenzene	100	ug/l		**2,000**		**3,100**		**2,200**		**1,500**		**510**
cis-1,2-Dichloroethene	70	ug/l	<	50	<	120	<	100	<	100	<	40
Ethylbenzene	700	ug/l	<	50	<	120	<	100	<	100	<	40
Methylbenzene (toluene)	1,000	ug/l	<	50	<	120	<	100	<	100	<	40
Naphthalene	100[6]	ug/l	<	20		**4**	<	20	<	100	<	40
Styrene	100	ug/l	<	50	<	120	<	100	<	100	<	40
Tetrachloroethene	5	ug/l	<	10	<	25	<	20	<	20	<	8
trans-1,2-Dichloroethene	100	ug/l	<	50	<	120	<	100	<	100	<	40
Trichloroethene	5	ug/l	<	10	<	25	<	20	<	20	<	8
Vinyl chloride	2	ug/l	<	10	<	25	<	20	<	20	<	8

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A									
			5/17/2016		8/17/2016		9/14/2016		10/31/2016		3/1/2017	
			RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	100	<	100	<	200	<	50	<	200
1,1,2-Tetrachloroethane	5	ug/l	<	100	<	100	<	200	<	50	<	200
1,1-Dichloroethane	2.4[6]	ug/l	<	20	<	20	<	40	<	10	<	40
1,1-Dichloroethene	7	ug/l	<	100	<	100	<	200	<	50	<	200
1,2,4-Trichlorobenzene	70	ug/l	<	100	<	100	<	200	<	50	<	200
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	100	<	100	<	200	<	50	<	200
1,2-Dibromoethane	0.05	ug/l	<	100	<	100	<	200	<	50	<	200
1,2-Dichlorobenzene	600	ug/l		**2,300**		**3,900**		**1,200**		**1,100**		**3,290**
1,2-Dichloroethane	5	ug/l	<	100	<	100	<	200	<	50	<	200
1,2-Dichloropropane	5	ug/l	<	100	<	100	<	200	<	50	<	200
1,3-Dichlorobenzene	600	ug/l	<	100	<	100	<	200	<	50	<	200
1,4-Dichlorobenzene	75	ug/l		**100**		**230**	<	200	<	50	<	200
1,4-Dioxane	-	ug/l		**200**		**340**	<	400		**390**		**447**
2-Butanone (MEK)	4,000[6]	ug/l	<	100	<	100	<	200	<	50	<	200
Benzene	5	ug/l	<	20		**44**	<	40	<	10		**42**
Carbon Tetrachloride	5	ug/l	<	100	<	100	<	200	<	50	<	200
Chlorobenzene	100	ug/l		**910**		**3,600**		**830**		**460**		**3,590**
cis-1,2-Dichloroethene	70	ug/l	<	100	<	100	<	200	<	50	<	200
Ethylbenzene	700	ug/l	<	100	<	100	<	200	<	50	<	200
Methylbenzene (toluene)	1,000	ug/l	<	100	<	100	<	200	<	50	<	200
Naphthalene	100[6]	ug/l	<	100	<	100	<	200	<	50	<	200
Styrene	100	ug/l	<	100	<	100	<	200	<	50	<	200
Tetrachloroethene	5	ug/l	<	20	<	20	<	40	<	10	<	40
trans-1,2-Dichloroethene	100	ug/l	<	100	<	100	<	200	<	50	<	200
Trichloroethene	5	ug/l	<	20	<	20	<	40	<	10	<	40
Vinyl chloride	2	ug/l	<	20	<	20	<	40	<	10	<	40

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A									
			5/1/2017		8/21/2017		11/15/2017		2/6/2018		5/7/2018	
			RESULT		RESULT*		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	100	<	50	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	100	<	50	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	20	<	10		**1.3**	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	100	<	50	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	100	<	50		**1.4**	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	100	<	50	<	2	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	200	<	50	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**1,520**		**1,820**		**3,700**	E	**3,000**		**1,700**
1,2-Dichloroethane	5	ug/l	<	100	<	50	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	100	<	50	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	100	<	50		**27**		**9.5**		**11**
1,4-Dichlorobenzene	75	ug/l	<	100		**116**		**210**		**78**		**83**
1,4-Dioxane	-	ug/l		**561**		**396**		**350**		**370**	J+	**590**
2-Butanone (MEK)	4,000[6]	ug/l	<	100	<	50	<	5		**85**	<	5
Benzene	5	ug/l	<	20		**13.2**		**33**		**7.9**		**11**
Carbon Tetrachloride	5	ug/l	<	100	<	50	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**827**		**1,520**		**3,700**	E	**1,700**		**1,340**
cis-1,2-Dichloroethene	70	ug/l	<	100	<	50	<	1	<	0.4	<	1
Ethylbenzene	700	ug/l	<	100	<	50		**1.2**	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	<	100	<	50		**1.3**	<	1	<	1
Naphthalene	100[6]	ug/l	<	100	<	50		NT		**2.1**		**2.6**
Styrene	100	ug/l	<	100	<	50	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	20	<	50	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	100	<	10	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	20	<	50	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	20	<	50	<	0.5	<	0.5	<	0.5

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 4: Central Landfill Groundwater Monitoring Results for MW03-ML12A

Parameter	Action Level	UNIT	MW03-ML12A							
			8/16/2018		11/8/2018		2/5/2019		5/7/2019	
			RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	40	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	40	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	40	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	40	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	40	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	80	<	2	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	40	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**1,900**		**1,400**		**730**		**2,500**
1,2-Dichloroethane	5	ug/l	<	40	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	40	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	40		14		**6.2**		**9.6**
1,4-Dichlorobenzene	75	ug/l	<	40		**110**		**48**		**84**
1,4-Dioxane	-	ug/l	<	4,000		**1,100**		**2,100**	J+	
2-Butanone (MEK)	4,000[6]	ug/l	<	200	<	10		**48**	<	10
Benzene	5	ug/l	<	40		**15**		**8.1**		**7**
Carbon Tetrachloride	5	ug/l	<	40	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**1,800**		**1,700**		**500**		**920**
cis-1,2-Dichloroethene	70	ug/l	<	40	<	1	<	0.4	<	1
Ethylbenzene	700	ug/l	<	40	<	1	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	<	40	<	1	<	1	<	1
Naphthalene	100[6]	ug/l	<	40	<	1		**1.1**		
Styrene	100	ug/l	<	40	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	40	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	40	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	40	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	20	<	0.5	<	0.5	<	0.5

Notes

Well screened in rock at elevation 317.6 to 328.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03ML12B									
			3/17/2015		5/5/2015		8/6/2015		12/16/2015		2/1/2016	
			RESULTS		RESULTS		RESULTS		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	100	<	120	<	100	<	25	<	40
1,1,2-Tetrachloroethane	5	ug/l	<	100	<	120	<	100	<	25	<	40
1,1-Dichloroethane	2.4[6]	ug/l	<	20	<	25	<	20	<	5	<	8
1,1-Dichloroethene	7	ug/l	<	100	<	120	<	100	<	25	<	40
1,2,4-Trichlorobenzene	70	ug/l	<	10	<	5	<	22	<	25	<	40
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	100	<	120	<	100	<	25	<	40
1,2-Dibromoethane	0.05	ug/l	<	100	<	120	<	100	<	25	<	40
1,2-Dichlorobenzene	600	ug/l		**260**		**410**		**220**		**45**		**27**
1,2-Dichloroethane	5	ug/l	<	100	<	120	<	100	<	25	<	40
1,2-Dichloropropane	5	ug/l	<	100	<	120	<	100	<	25	<	40
1,3-Dichlorobenzene	600	ug/l	<	10	<	5	<	22	<	25	<	20
1,4-Dichlorobenzene	75	ug/l		**24**		**34**	<	22	<	25	<	40
1,4-Dioxane	-	ug/l		**320**		**830**		**470**		**400**	J	**470**
2-Butanone (MEK)	4,000[6]	ug/l	<	100	<	120	<	100	<	25	<	40
Benzene	5	ug/l	<	20		**27**		**24**		**10**	<	8
Carbon Tetrachloride	5	ug/l	<	100	<	120	<	100	<	25	<	40
Chlorobenzene	100	ug/l		**2,400**		**4,000**		**3,500**		**810**	J	**800**
cis-1,2-Dichloroethene	70	ug/l	<	100	<	120	<	100	<	25	<	40
Ethylbenzene	700	ug/l	<	100	<	120	<	100	<	25	<	40
Methylbenzene (toluene)	1,000	ug/l	<	100	<	120	<	100	<	25	<	40
Naphthalene	100[6]	ug/l	<	2	<	1	<	4.4	<	25	<	40
Styrene	100	ug/l	<	100	<	120	<	100	<	25	<	40
Tetrachloroethene	5	ug/l	<	20	<	25	<	20	<	5	<	8
trans-1,2-Dichloroethene	100	ug/l	<	100	<	120	<	100	<	25	<	40
Trichloroethene	5	ug/l	<	20	<	25	<	20	<	5	<	8
Vinyl chloride	2	ug/l	<	20	<	25	<	20	<	5	<	8

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03-ML12B									
			5/17/2016		8/17/2016		9/14/2016		10/31/2016		3/1/2017	
			RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	200	<	200	<	200	<	50	<	25
1,1,2-Tetrachloroethane	5	ug/l	<	200	<	200	<	200	<	50	<	25
1,1-Dichloroethane	2.4[6]	ug/l	<	40	<	40	<	40	<	10	<	5
1,1-Dichloroethene	7	ug/l	<	200	<	200	<	200	<	50	<	25
1,2,4-Trichlorobenzene	70	ug/l	<	200	<	200	<	200	<	50	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	200	<	200	<	200	<	50	<	25
1,2-Dibromoethane	0.05	ug/l	<	200	<	200	<	200	<	50	<	25
1,2-Dichlorobenzene	600	ug/l	<	200	<	200		**290**		**31**		**67.5**
1,2-Dichloroethane	5	ug/l	<	200	<	200	<	200	<	50	<	25
1,2-Dichloropropane	5	ug/l	<	200	<	200	<	200	<	50	<	25
1,3-Dichlorobenzene	600	ug/l	<	200	<	200	<	200	<	50	<	25
1,4-Dichlorobenzene	75	ug/l	<	200	<	200	<	200	<	50	<	25
1,4-Dioxane	-	ug/l		560	<	400	<	400		**350**		**330**
2-Butanone (MEK)	4,000[6]	ug/l	<	200	<	200	<	200	<	50	<	25
Benzene	5	ug/l		48		**44**		**61**	<	10		**8.3**
Carbon Tetrachloride	5	ug/l	<	200	<	200	<	200	<	50	<	25
Chlorobenzene	100	ug/l		**4,800**		**4,600**		**6,200**		**1,300**		**586**
cis-1,2-Dichloroethene	70	ug/l	<	200	<	200	<	200	<	50	<	25
Ethylbenzene	700	ug/l	<	200	<	200	<	200	<	50	<	25
Methylbenzene (toluene)	1,000	ug/l	<	200	<	200	<	200	<	50	<	25
Naphthalene	100[6]	ug/l	<	200	<	200	<	200	<	1	<	25
Styrene	100	ug/l	<	200	<	200	<	200	<	50	<	25
Tetrachloroethene	5	ug/l	<	40	<	40	<	40	<	10	<	5
trans-1,2-Dichloroethene	100	ug/l	<	200	<	200	<	200	<	50	<	25
Trichloroethene	5	ug/l	<	40	<	40	<	40	<	10	<	5
Vinyl chloride	2	ug/l	<	40	<	40	<	40	<	10	<	5

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03ML12B									
			5/1/2017		8/21/2017		11/15/2017		2/6/2018		5/7/2018	
			RESULT		RESULT*		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	25	<	5	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	5	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	5	<	1	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	25	<	5	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	5	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	5	<	2	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	25	<	5	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**103**		**155**		**69**	J	54		**44**
1,2-Dichloroethane	5	ug/l	<	25	<	5	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	25	<	5	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	25		**5.05**		**1.6**	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	25		**63**		**21**		**6.4**		**5**
1,4-Dioxane	-	ug/l		**407**		**349**		**350**		**320**	J+	**340**
2-Butanone (MEK)	4,000[6]	ug/l	<	25	<	5	<	5	<	5	<	5
Benzene	5	ug/l	<	10		**58.7**		**13**		**9.4**		**6.1**
Carbon Tetrachloride	5	ug/l	<	25	<	5	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**1,110**		**4,200**		**3,300**	E	**970**		**599**
cis-1,2-Dichloroethene	70	ug/l	<	25	<	5	<	1	<	0.4	<	1
Ethylbenzene	700	ug/l	<	25	<	5	<	1		**1.1**	<	1
Methylbenzene (toluene)	1,000	ug/l	<	25	<	5	<	1		**2.6**		**2.5**
Naphthalene	100[6]	ug/l	<	25	<	5		**1.1**	<	1	<	1
Styrene	100	ug/l	<	25	<	5	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	5	<	5	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	25	<	1	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	5	<	5	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	5	<	5	<	0.5	<	0.5	<	0.5

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 5: Central Landfill Groundwater Monitoring Results for MW03-ML12B

Parameter	Action Level	UNIT	MW03-ML12B							
			8/16/2018		11/8/2018		2/5/2019		5/7/2019	
			RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	40	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	40	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	40	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	40	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	40	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	80	<	2	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	40	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**110**		**62**		**22**		**38.5**
1,2-Dichloroethane	5	ug/l	<	40	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	40	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	40	<	1	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	40		**6.4**		**2.1**		**4.2**
1,4-Dioxane	-	ug/l	<	4,000		**290**		**1,000**		**205**
2-Butanone (MEK)	4,000[6]	ug/l	<	200	<	10		**35**		**31.4**
Benzene	5	ug/l		**43**		**13**		**5.2**		**10.4**
Carbon Tetrachloride	5	ug/l	<	40	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**3,100**		**1,000**		**130**		**1,590**
cis-1,2-Dichloroethene	70	ug/l	<	40	<	1	<	0.4	<	1
Ethylbenzene	700	ug/l	<	40	<	1	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	<	40		**2**		**1.3**		**5.2**
Naphthalene	100[6]	ug/l	<	40	<	1	<	1	<	1
Styrene	100	ug/l	<	40	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	40	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	40	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	40	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	20	<	0.5	<	0.5		**1.3**

Notes:

Well screened in rock at elevation 279.6 to 300.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C									
			3/18/2015		5/5/2015		12/16/2015		2/25/2016		5/17/2016	
			RESULTS		RESULTS		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	U	25	<	5	<	25	<	25	<	25
1,1,2-Tetrachloroethane	5	ug/l	U	25	<	5	<	25	<	25	<	25
1,1-Dichloroethane	2.4[6]	ug/l	U	5	<	1	<	5	<	5	<	5
1,1-Dichloroethene	7	ug/l	U	25	<	5	<	25	<	25	<	25
1,2,4-Trichlorobenzene	70	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dibromoethane	0.05	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dichlorobenzene	600	ug/l	U	25		**16**	<	25		**30**		**46**
1,2-Dichloroethane	5	ug/l	U	25	<	5	<	25	<	25	<	25
1,2-Dichloropropane	5	ug/l	U	25	<	5	<	25	<	25	<	25
1,3-Dichlorobenzene	600	ug/l	U	25	<	5	<	25	<	25	<	25
1,4-Dichlorobenzene	75	ug/l	U	25	<	5	<	25	<	25	<	25
1,4-Dioxane	-	ug/l	U	25	<	5		**30**	<	50	<	25
2-Butanone (MEK)	4,000[6]	ug/l	U	25	<	5	<	25	<	25	<	25
Benzene	5	ug/l	U	5	<	1	<	5		**5.2**	<	5
Carbon Tetrachloride	5	ug/l	U	25	<	5	<	25	<	25	<	25
Chlorobenzene	100	ug/l		**110**		**18**		**280**		**480**		**660**
cis-1,2-Dichloroethene	70	ug/l	U	25	<	5	<	25	<	25	<	25
Dichloromethane	5	ug/l	U	5	<	1	<	5	<	5	<	5
Ethylbenzene	700	ug/l	U	25	<	5	<	25	<	25	<	25
Methylbenzene (toluene)	1,000	ug/l		NT	<	5	<	25	<	25	<	25
Naphthalene	100	ug/l	U	25	<	1.1	<	25	<	25	<	25
Styrene	100	ug/l	U	25	<	5	<	25	<	25	<	25
Tetrachloroethene	5	ug/l	U	5	<	1	<	5	<	5	<	5
trans-1,2-Dichloroethene	100	ug/l	U	25	<	5	<	25	<	25	<	25
Trichloroethene	5	ug/l	U	5	<	1	<	5	<	5	<	5
Vinyl chloride	2	ug/l	U	5	<	1	<	5	<	5	<	5

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C									
			8/17/2016		9/14/2016		10/31/2016		5/1/2017		5/1/2017	
			RESULT		RESULT		RESULT		RESULT		RESULT-DUP	
1,1,1-Trichloroethane	200	ug/l	<	25	<	25	<	25	<	25	<	50
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	25	<	25	<	25	<	50
1,1-Dichloroethane	2.4[6]	ug/l	<	5	<	5	<	5	<	5	<	10
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	25	<	25	<	50
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	25	<	25	<	25	<	50
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	25	<	25	<	50
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	25	<	25	<	50
1,2-Dichlorobenzene	600	ug/l		**35**		**64**	<	25	<	25	<	50
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	25	<	25	<	50
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	25	<	25	<	50
1,3-Dichlorobenzene	600	ug/l	<	25	<	25	<	25	<	25	<	50
1,4-Dichlorobenzene	75	ug/l	<	25	<	25	<	25	<	25	<	50
1,4-Dioxane	-	ug/l	<	50	<	50	<	25	<	25	<	50
2-Butanone (MEK)	4,000[6]	ug/l	<	25	<	25	<	25	<	25	<	50
Benzene	5	ug/l		**5.6**	<	5	<	5	<	5	<	10
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	25	<	25	<	50
Chlorobenzene	100	ug/l		**540**		**1,100**		**150**		**150**		**71.5**
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	25	<	25	<	50
Dichloromethane	5	ug/l	<	5	<	5	<	5	<	5	<	10
Ethylbenzene	700	ug/l	<	25	<	25	<	25	<	25	<	50
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25	<	25	<	25	<	50
Naphthalene	100	ug/l	<	25	<	25	<	25	<	25	<	50
Styrene	100	ug/l	<	25	<	25	<	25	<	25	<	50
Tetrachloroethene	5	ug/l	<	5	<	5	<	5	<	25	<	50
trans-1,2-Dichloroethene	100	ug/l	<	25	<	25	<	25	<	5	<	10
Trichloroethene	5	ug/l	<	5	<	5	<	5	<	25	<	50
Vinyl chloride	2	ug/l	<	5	<	5	<	5	<	25	<	50

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C									
			8/21/2017		11/15/2017		2/6/2018		5/7/2018		8/16/2018	
			RESULT*		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	5	<	1	<	1	<	1	<	10
1,1,2-Tetrachloroethane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,1-Dichloroethane	2.4[6]	ug/l	<	1	<	1	<	1	<	1	<	10
1,1-Dichloroethene	7	ug/l	<	5	<	1	<	1	<	1	<	10
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	5	<	2	<	2	<	2	<	20
1,2-Dibromoethane	0.05	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dichlorobenzene	600	ug/l		**8.75**		**39**		**39**		**11**		**15**
1,2-Dichloroethane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dichloropropane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,3-Dichlorobenzene	600	ug/l	<	5	<	1	<	1	<	1	<	10
1,4-Dichlorobenzene	75	ug/l	<	5		**8.6**		**4.3**	<	1	<	10
1,4-Dioxane	-	ug/l		**20.2**		**25**		**45**	<	100	<	1,000
2-Butanone (MEK)	4,000[6]	ug/l		**73**		**29**		**56**		**110**	<	50
Benzene	5	ug/l		**1.18**	<	1		**6.2**		**1.6**	<	10
Carbon Tetrachloride	5	ug/l	<	5	<	1	<	1	<	1	<	10
Chlorobenzene	100	ug/l		**55.6**		**440**	E	**700**		**69**		**140**
cis-1,2-Dichloroethene	70	ug/l	<	5	<	1	<	0.4	<	1	<	10
Dichloromethane	5	ug/l	<	1	<	1	<	1	<	1	<	10
Ethylbenzene	700	ug/l	<	5	<	1		**1.1**	<	1	<	10
Methylbenzene (toluene)	1,000	ug/l	<	5		**4.8**		**3.8**		**1.1**	<	10
Naphthalene	100	ug/l	<	5		**2.4**	<	1	<	1	<	10
Styrene	100	ug/l	<	5	<	1	<	1	<	1	<	10
Tetrachloroethene	5	ug/l	<	5	<	1	<	1	<	1	<	10
trans-1,2-Dichloroethene	100	ug/l	<	1	<	1	<	1	<	1	<	10
Trichloroethene	5	ug/l	<	5	<	1	<	1	<	1	<	10
Vinyl chloride	2	ug/l	<	5	<	0.5	<	0.5	<	0.5	<	5

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 6: Central Landfill Groundwater Monitoring Results for MW03-ML12C

Parameter	Action Level	UNIT	MW03-ML12C					
			11/8/2018		2/5/2019		5/7/2019	
			RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	2	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**13**		**8.4**		**33**
1,2-Dichloroethane	5	ug/l	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	1	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	1	<	1		**4.4**
1,4-Dioxane	-	ug/l		**38**	<	100		**222**
2-Butanone (MEK)	4,000[6]	ug/l		**180**		**120**		**27**
Benzene	5	ug/l		**1.4**	<	**1.3**		**6.6**
Carbon Tetrachloride	5	ug/l	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**67**		**57**		**438**
cis-1,2-Dichloroethene	70	ug/l	<	1	<	0.4	<	1
Dichloromethane	5	ug/l	<	5	<	1	<	1
Ethylbenzene	700	ug/l	<	1		**1.1**	<	1
Methylbenzene (toluene)	1,000	ug/l	<	1	<	1		**2.7**
Naphthalene	100	ug/l	<	1	<	1	<	1
Styrene	100	ug/l	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	0.5	<	0.5	<	1

Notes

Well screened in rock at elevation 235.6 to 245.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03ML12D									
			3/17/2015		5/5/2015		8/6/2015		11/17/2015		2/1/2016	
			RESULTS		RESULTS		RESULTS		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	25	<	25	<	25	<	25	<	25
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	25	<	25	<	25	<	25
1,1-Dichloroethane	2.4[6]	ug/l	<	5	<	5	<	5	<	5	<	5
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	25	<	25	<	25
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	5	<	5	<	25	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	25	<	25	<	25
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	25	<	25	<	25
1,2-Dichlorobenzene	600	ug/l		**48**		**60**		**37**		**44**		**41**
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	25	<	25	<	25
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	25	<	25	<	25
1,3-Dichlorobenzene	600	ug/l	<	5	<	5	<	5	<	25	<	25
1,4-Dichlorobenzene	75	ug/l		**6.6**		**5.6**		**5.3**	<	25	<	25
1,4-Dioxane	-	ug/l	J	**58**	<	25		**71**	<	100		**53**
2-Butanone (MEK)	4,000[6]	ug/l	<	25	<	25	<	25	<	25	<	25
Benzene	5	ug/l	<	5	<	5		**6**	<	5	<	5
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	25	<	25	<	25
Chlorobenzene	100	ug/l		**760**		**600**		**990**		**680**		**510**
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	25	<	25	<	25
Dichloromethane	5	ug/l	<	5	<	5	<	5	<	5	<	5
Ethylbenzene	700	ug/l	<	25	<	25	<	25	<	25	<	25
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25	<	25	<	25	<	25
Naphthalene	100[6]	ug/l	<	1	<	1	<	1	<	25	<	25
Styrene	100	ug/l	<	25	<	25	<	25	<	25	<	25
Tetrachloroethene	5	ug/l	<	5	<	5	<	5	<	5	<	5
trans-1,2-Dichloroethene	100	ug/l	<	25	<	25	<	25	<	25	<	25
Trichloroethene	5	ug/l	<	5	<	5	<	5	<	5	<	5
Vinyl chloride	2	ug/l	<	5	<	5	<	5	<	5	<	5

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03ML12D											
			5/17/2016		8/17/2016		9/14/2016		10/31/2016		3/1/2017		5/1/2017	
			RESULT		RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,1,2-Tetrachloroethane	5	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,1-Dichloroethane	2.4[6]	ug/l	<	4	<	4	<	5	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,2,4-Trichlorobenzene	70	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,2-Dibromoethane	0.05	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,2-Dichlorobenzene	600	ug/l		**110**		**110**		**160**		**48**		**24.9**		**20.4**
1,2-Dichloroethane	5	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,2-Dichloropropane	5	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,3-Dichlorobenzene	600	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,4-Dichlorobenzene	75	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
1,4-Dioxane	-	ug/l	<	20	<	40	<	50		**34**		**27.9**		**32.2**
2-Butanone (MEK)	4,000[6]	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Benzene	5	ug/l	<	4	<	4	<	5		**6.5**	<	1	<	1
Carbon Tetrachloride	5	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Chlorobenzene	100	ug/l		**640**		**720**		**740**		**650**		**69.4**		**82.1**
cis-1,2-Dichloroethene	70	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Dichloromethane	5	ug/l	<	4	<	4	<	5	<	1	<	1	<	1
Ethylbenzene	700	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Methylbenzene (toluene)	1,000	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Naphthalene	100[6]	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Styrene	100	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Tetrachloroethene	5	ug/l	<	4	<	4	<	5	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	20	<	20	<	25	<	5	<	5	<	5
Trichloroethene	5	ug/l	<	4	<	4	<	5	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	4	<	4	<	5	<	1	<	1	<	1

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03-ML12D									
			8/21/2017		11/15/2017		2/6/2018		5/7/2018		8/16/2018	
			RESULT*		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	5	<	1	<	1	<	1	<	10
1,1,2-Tetrachloroethane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,1-Dichloroethane	2.4[6]	ug/l	<	1	<	1	<	1	<	1	<	10
1,1-Dichloroethene	7	ug/l	<	5	<	1	<	1	<	1	<	10
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	5	<	2	<	2	<	2	<	20
1,2-Dibromoethane	0.05	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dichlorobenzene	600	ug/l		**28.8**		**30**		**16**		**8.6**		**15**
1,2-Dichloroethane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,2-Dichloropropane	5	ug/l	<	5	<	1	<	1	<	1	<	10
1,3-Dichlorobenzene	600	ug/l	<	5	<	1	<	1	<	1	<	10
1,4-Dichlorobenzene	75	ug/l	<	5		**2.9**	<	1	<	1	<	10
1,4-Dioxane	-	ug/l		**29.3**		**39**		**37**	<	100	<	1,000
2-Butanone (MEK)	4,000[6]	ug/l		**6.98**		**14**		**20**	<	5	<	50
Benzene	5	ug/l		**5.18**		**6.1**		**2.6**	<	1	<	10
Carbon Tetrachloride	5	ug/l	<	5	<	1	<	1	<	1	<	10
Chlorobenzene	100	ug/l		**176**		**620**		**160**		**50**		**170**
cis-1,2-Dichloroethene	70	ug/l	<	5	<	1	<	0.4	<	1	<	10
Dichloromethane	5	ug/l	<	1	<	1	<	1	<	1	<	10
Ethylbenzene	700	ug/l	<	5	<	1	<	1	<	1	<	10
Methylbenzene (toluene)	1,000	ug/l	<	5		**2.6**		**1.6**	<	1	<	10
Naphthalene	100[6]	ug/l	<	5	<	1	<	1	<	1	<	10
Styrene	100	ug/l	<	5	<	1	<	1	<	1	<	10
Tetrachloroethene	5	ug/l	<	5	<	1	<	1	<	1	<	10
trans-1,2-Dichloroethene	100	ug/l	<	1	<	1	<	1	<	1	<	10
Trichloroethene	5	ug/l	<	5	<	1	<	1	<	1	<	10
Vinyl chloride	2	ug/l	<	5	<	0.5	<	0.5	<	0.5	<	5

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 7: Central Landfill Groundwater Monitoring Results for MW03-ML12D

Parameter	Action Level	UNIT	MW03-ML12D					
			11/8/2018		2/5/2019		5/7/2019	
			RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	1	<	1		**1.3**
1,1-Dichloroethene	7	ug/l	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	2	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**14**		**51**		**98**
1,2-Dichloroethane	5	ug/l	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	1	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	1		**4.3**		**4.3**
1,4-Dioxane	-	ug/l		**25**		**110**		**147**
2-Butanone (MEK)	4,000[6]	ug/l	<	10	<	10		**5.6**
Benzene	5	ug/l	<	1		**7.1**		**9.7**
Carbon Tetrachloride	5	ug/l	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**100**		**510**		**402**
cis-1,2-Dichloroethene	70	ug/l	<	1	<	0.4	<	1
Dichloromethane	5	ug/l	<	5	<	1	<	1
Ethylbenzene	700	ug/l	<	1	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l		**1.2**		**5.1**		**5.1**
Naphthalene	100[6]	ug/l	<	1	<	1	<	1
Styrene	100	ug/l	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	0.5	<	0.5		**1.4**

Notes

Well screened in rock at elevation 209.6 to 222.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML12E									
			3/17/2015		5/5/2015		8/6/2015		11/17/2015		12/16/2015	
			RESULTS		RESULTS		RESULTS		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	10	<	5	<	25	<	5	<	25
1,1,2-Tetrachloroethane	5	ug/l	<	10	<	5	<	25	<	5	<	25
1,1-Dichloroethane	2.4[6]	ug/l	<	2	<	1	<	5	<	1	<	5
1,1-Dichloroethene	7	ug/l	<	10	<	5	<	25	<	5	<	25
1,2,4-Trichlorobenzene	70	ug/l	<	5	<	5	<	25	<	100	<	25
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	10	<	5	<	25	<	5	<	25
1,2-Dibromoethane	0.05	ug/l	<	10	<	5	<	25	<	5	<	25
1,2-Dichlorobenzene	600	ug/l		**14**		**32**		**33**		**11**		**53**
1,2-Dichloroethane	5	ug/l	<	10	<	5	<	25	<	5	<	25
1,2-Dichloropropane	5	ug/l	<	10	<	5	<	25	<	5	<	25
1,3-Dichlorobenzene	600	ug/l	<	5	<	5	<	25	<	5	<	25
1,4-Dichlorobenzene	75	ug/l	<	5	<	5	<	25	<	5	<	25
1,4-Dioxane	-	ug/l	<	10		**24**	<	25	<	20	<	25
2-Butanone (MEK)	4,000[6]	ug/l	<	10		**13**	<	25		**7.2**	<	25
Benzene	5	ug/l	<	2		**4.2**	<	5		2		**5.6**
Carbon Tetrachloride	5	ug/l	<	10	<	5	<	25	<	5	<	25
Chlorobenzene	100	ug/l		**190**		**500**		**530**		**140**		**560**
cis-1,2-Dichloroethene	70	ug/l	<	10	<	5	<	25	<	5	<	25
Dichloromethane	5	ug/l	<	2	<	1	<	5	<	1	<	5
Ethylbenzene	700	ug/l	<	10	<	5	<	25	<	5	<	25
Methylbenzene (toluene)	1,000	ug/l	<	10		**8.1**	<	25	<	5	<	25
Naphthalene	100[6]	ug/l	<	1	<	1.1	<	25	<	5	<	25
Styrene	100	ug/l	<	10	<	5	<	25	<	5	<	25
Tetrachloroethene	5	ug/l	<	2	<	1	<	5	<	1	<	5
trans-1,2-Dichloroethene	100	ug/l	<	10	<	5	<	25	<	5	<	25
Trichloroethene	5	ug/l	<	2	<	1	<	5	<	1	<	5
Vinyl chloride	2	ug/l	<	2	<	1	<	5	<	1	<	5

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection limit

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML-12E											
			2/1/2016		5/17/2016		8/17/2016		9/14/2016		10/31/2016		3/1/2017	
			RESULT		RESULT		RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,1,2-Tetrachloroethane	5	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,1-Dichloroethane	2.4[6]	ug/l	<	5	<	5	<	1	<	1	<	1	<	4
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,2-Dichlorobenzene	600	ug/l		**40**		**31**		**10**		**46**		**32**		**21.3**
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,3-Dichlorobenzene	600	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,4-Dichlorobenzene	75	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
1,4-Dioxane	-	ug/l	<	25	<	25	<	10		**12**	<	5	<	20
2-Butanone (MEK)	4,000[6]	ug/l	<	25	<	25	<	5	<	5		**10**	<	20
Benzene	5	ug/l	<	5	<	5		**1.6**		**5.8**		**5.6**		**4.24**
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
Chlorobenzene	100	ug/l		**530**		**460**		**120**		**590**		**160**		**340**
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
Dichloromethane	5	ug/l	<	5	<	5	<	1		**1.1**	<	1	<	4
Ethylbenzene	700	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25	<	5		**8.2**	<	5	<	20
Naphthalene	100[6]	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
Styrene	100	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
Tetrachloroethene	5	ug/l	<	5	<	5	<	1	<	1	<	1	<	4
trans-1,2-Dichloroethene	100	ug/l	<	25	<	25	<	5	<	5	<	5	<	20
Trichloroethene	5	ug/l	<	5	<	5	<	1	<	1	<	1	<	4
Vinyl chloride	2	ug/l	<	5	<	5	<	1	<	1	<	1	<	4

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection l

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML12E									
			5/1/2017		8/21/2017		11/15/2017		2/6/2018		5/7/2018	
			RESULT		RESULT*		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	5	<	25	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	5	<	25	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	25	<	5	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	25	<	25	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	25	<	25	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	25	<	25	<	2	<	2	<	2
1,2-Dibromoethane	0.05	ug/l	<	25	<	25	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l	<	25	<	25		**28**		**36**		**29**
1,2-Dichloroethane	5	ug/l	<	25	<	25	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	25	<	25	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	25	<	25	<	1	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	25	<	25		3		**4.1**		**3.8**
1,4-Dioxane	-	ug/l	<	25	<	25		**22**		**28**	<	100
2-Butanone (MEK)	4,000[6]	ug/l	<	25	<	25		**13**		**10**		**22**
Benzene	5	ug/l	<	5	<	5		**5.9**		**7.3**		**6.3**
Carbon Tetrachloride	5	ug/l	<	25	<	25	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**150**		**224**		**620**	E	**790**		**579**
cis-1,2-Dichloroethene	70	ug/l	<	25	<	25	<	1	<	0.4	<	1
Dichloromethane	5	ug/l	<	5	<	5	<	1	<	1	<	1
Ethylbenzene	700	ug/l	<	25	<	25	<	1		**1.1**	<	1
Methylbenzene (toluene)	1,000	ug/l	<	25	<	25		**2.8**		**4.7**		**3**
Naphthalene	100[6]	ug/l	<	25	<	25	<	1	<	1	<	1
Styrene	100	ug/l	<	25	<	25	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	25	<	25	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	5	<	5	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	25	<	25	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	25	<	25	<	0.5	<	0.5	<	0.5

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection l

Table 8: Central Landfill Groundwater Monitoring Results for MW03-ML12E

Parameter	Action Level	UNIT	MW03-ML12E							
			8/16/2018		11/8/2018		2/5/2019		5/7/2019	
			RESULT		RESULT		RESULT		RESULT	
1,1,1-Trichloroethane	200	ug/l	<	10	<	1	<	1	<	1
1,1,2-Tetrachloroethane	5	ug/l	<	10	<	1	<	1	<	1
1,1-Dichloroethane	2.4[6]	ug/l	<	10	<	1	<	1	<	1
1,1-Dichloroethene	7	ug/l	<	10	<	1	<	1	<	1
1,2,4-Trichlorobenzene	70	ug/l	<	10	<	1	<	1	<	1
1,2-Dibromo-3-Chloropropane (DBCP)	0.2	ug/l	<	20	<	2	<	2	<	1
1,2-Dibromoethane	0.05	ug/l	<	10	<	1	<	1	<	1
1,2-Dichlorobenzene	600	ug/l		**31**		**12**		**33**		**12.5**
1,2-Dichloroethane	5	ug/l	<	10	<	1	<	1	<	1
1,2-Dichloropropane	5	ug/l	<	10	<	1	<	1	<	1
1,3-Dichlorobenzene	600	ug/l	<	10	<	1	<	1	<	1
1,4-Dichlorobenzene	75	ug/l	<	10	<	1		**4.3**	<	1
1,4-Dioxane	-	ug/l	<	1,000		**33**	<	100		**122**
2-Butanone (MEK)	4,000[6]	ug/l	<	50		**78**		**34**		**43.5**
Benzene	5	ug/l	<	10		**2.5**		**6.6**		**3**
Carbon Tetrachloride	5	ug/l	<	10	<	1	<	1	<	1
Chlorobenzene	100	ug/l		**500**		**110**		**250**		**125**
cis-1,2-Dichloroethene	70	ug/l	<	10	<	1	<	0.4	<	1
Dichloromethane	5	ug/l	<	10	<	5	<	1	<	1
Ethylbenzene	700	ug/l	<	10	<	1	<	1	<	1
Methylbenzene (toluene)	1,000	ug/l	<	10		**1.9**		**2.8**		**1.7**
Naphthalene	100[6]	ug/l	<	10	<	1	<	1	<	1
Styrene	100	ug/l	<	10	<	1	<	1	<	1
Tetrachloroethene	5	ug/l	<	10	<	1	<	1	<	1
trans-1,2-Dichloroethene	100	ug/l	<	10	<	1	<	1	<	1
Trichloroethene	5	ug/l	<	10	<	1	<	1	<	1
Vinyl chloride	2	ug/l	<	5	<	0.5	<	0.5	<	1

Notes

Well screened in rock at elevation 148.6 to 158.6

Orange indicates exceedence of action levels

Bold indicates compound detected above method detection l

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDEM GB Groundwater Objectives	Units	Date 08/24/2011		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**7**	1	**6**	1	**8**	1	**12**	1	**30**	1
	Methyl tert-Butyl Ether	5,000	µg/L	1	1	1	1	2	1	4	1	7	1
	cis-1,2-Dichloroethene	2,400	µg/L	15	1	16	1	16	1	16	1	17	1
	Trichloroethene	540	µg/L	114	10	102	10	99	10	94	1	50	1
	Tetrachloroethene	150	µg/L	2	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	**139**		**126**		**124**		**125**		**104**	
	% Parent Products	NS	%	**84%**		**81%**		**80%**		**75%**		**48%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.5		6.3		6.2		NT		6.2	
	CONDUCTIVITY	NS	mS/cm	0.580		0.650		0.688		NT		0.650	
	TURBIDITY	NS	NTU	5		4		NT		NT		5	
	DISSOLVED OXYGEN	NS	mg/L	0.7		1.1		0.9		NT		0.5	
	TEMPERATURE	NS	°C	18.2		15.7		12.9		NT		20.6	
	ORP	NS	mV	104		155		177		NT		72	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date		Date	
				12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014		09/10/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**														
	Vinyl Chloride	2	µg/L	**50**	1	**44**	1	**23**	1	**17**	1	**20**	1	**19**	1
	Methyl tert-Butyl Ether	5,000	µg/L	13	1	9	1	6	1	3	1	2	1	2	1
	cis-1,2-Dichloroethene	2,400	µg/L	27	1	20	1	15	1	7	1	10	1	8	1
	Trichloroethene	540	µg/L	1	1	57	1	37	1	23	1	36	1	57	1
	Tetrachloroethene	150	µg/L	85	1	<	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	**179**		**131**		**76**		**48**		**69**		**86**	
	% Parent Products	NS	%	**47%**		**43%**		**48%**		**49%**		**52%**		**66%**	
	FIELD PARAMETERS														
	pH	NS	SU	6.5		6.3		6.4		6.3		6.2		6.1	
	CONDUCTIVITY	NS	mS/cm	0.980		0.848		0.760		0.070		0.833		0.830	
	TURBIDITY	NS	NTU	4		7		18		5		8		10	
	DISSOLVED OXYGEN	NS	mg/L	3.3		NT		0.9		0.7		0.5		0.9	
	TEMPERATURE	NS	°C	16.8		12.1		15.2		19.6		11.4		19.1	
	ORP	NS	mV	113		82		87		150		32		-26	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND H

< = NOT DETECTED

NS = NO STANDARD NT = NOT

BGS = BELOW GROUND SURFACE

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDEM GB Groundwater Objectives	Units	Date 04/08/2015		Date 09/17/2015		Date 03/31/2016		Date 10/13/2016		Date 03/29/2017	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**13**	1	**8**	1	**16**	1	**17**	1	**8**	1
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	4	1	4	1	4	1	15	1	4	1
	Trichloroethene	540	µg/L	12	1	14	1	11	1	352	1	14	1
	Tetrachloroethene	150	µg/L	<	1	<	1	<	1	2	1	<	1
	Total VOCs	NS	µg/L	**29**		**26**		**32**		**386**		**26**	
	% Parent Products	NS	%	**42%**		**54%**		**34%**		**92%**		**54%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.4		6.7		6.1		6.6		6.2	
	CONDUCTIVITY	NS	mS/cm	0.581		0.920		1.030		0.419		1.270	
	TURBIDITY	NS	NTU	10		12		3		5		3	
	DISSOLVED OXYGEN	NS	mg/L	2.0		4.5		2.4		9.5		0.4	
	TEMPERATURE	NS	°C	9.7		19.5		12.8		16.4		12.3	
	ORP	NS	mV	141		-46		128		147		145	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND H

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

Table 9: Former Plating Facility Groundwater Monitoring Results for GZ-2

GZ-2 (Up Gradient) Screen From 10'-20' BGS		RIDEM GB Groundwater Objectives	Units	Date 09/21/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**										
	Vinyl Chloride	2	µg/L	**3**	1	**5**	1	**3**	1	1	1
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	82	1	5	1	2	1	3	1
	Trichloroethene	540	µg/L	40	1	30	1	10	1	28	1
	Tetrachloroethene	150	µg/L	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	**125**		**39**		**16**		**32**	
	% Parent Products	NS	%	**32%**		**76%**		**65%**		**86%**	
	FIELD PARAMETERS										
	pH	NS	SU	6.1		NT		6.0		6.1	
	CONDUCTIVITY	NS	mS/cm	0.511		NT		0.549		1.020	
	TURBIDITY	NS	NTU	2		NT		13		5	
	DISSOLVED OXYGEN	NS	mg/L	2.2		NT		1.3		0.5	
	TEMPERATURE	NS	°C	18.9		NT		19.3		12.5	
	ORP	NS	mV	198		NT		181		165	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND H

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date Baseline		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	2	1	**7**	1	**2**	1	**5**	1
	1,1,1-Trichloroethane	NS	µg/L	6	1	2	1	2	1	2	1	4	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1	1
	1,1-Dichloroethene	7	µg/L	3	1	2	1	4	1	4	1	5	1
	1,2-Dichloroethane	110	µg/L	6	1	5	1	5	1	5	1	7	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	2	1	<	1	3	1	3	1
	cis-1,2-Dichloroethene	2,400	µg/L	80	1	174	1	294	1	237	20	630	20
	Toluene	1,700	µg/L	2	1	2	1	2	1	1	1	2	1
	Trichloroethene	540	µg/L	**1,550**	50	**1,050**	50	**843**	50	**1,420**	20	**1,290**	20
	Tetrachloroethene	150	µg/L	**503**	50	**356**	50	**347**	50	**445**	20	**432**	20
	Total VOCs	NS	µg/L	**2,174**		**1,748**		**1,651**		**2,278**		**2,481**	
	% Parent Products	NS	%	**94%**		**80%**		**72%**		**82%**		**69%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.8		6.1		6.3		NT		6.2	
	CONDUCTIVITY	NS	mS/cm	2.280		5.820		5.866		NT		3.780	
	TURBIDITY	NS	NTU	691		29		NT		NT		7	
	DISSOLVED OXYGEN	NS	mg/L	5.6		1.4		2.3		NT		2.1	
	TEMPERATURE	NS	°C	20.2		15.6		13.6		NT		21.8	
	ORP	NS	mV	191		33		28		NT		71	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**3**	1	<	1	<	1	1	1	1	1
	1,1,1-Trichloroethane	NS	µg/L	4	1	3	1	5	1	5	1	3	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	2	1	2	1	2	1
	1,1-Dichloroethane	NS	µg/L	2	1	1	1	2	1	3	1	2	1
	1,1-Dichloroethene	7	µg/L	7	1	4	1	7	1	**8**	1	6	1
	1,2-Dichloroethane	110	µg/L	11	1	8	1	13	1	18	1	13	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	3	1	6	1	8	1	8	1
	cis-1,2-Dichloroethene	2,400	µg/L	634	20	279	50	436	50	529	50	426	100
	Toluene	1,700	µg/L	3	1	3	1	7	1	12	1	33	1
	Trichloroethene	540	µg/L	**1,980**	20	**2,680**	50	**4,390**	50	**7,230**	50	**8,650**	100
	Tetrachloroethene	150	µg/L	**422**	20	**720**	50	**801**	50	**686**	50	**603**	100
	Total VOCs	NS	µg/L	**3,159**		**3,766**		**5,747**		**8,596**		**9,825**	
	% Parent Products	NS	%	**76%**		**90%**		**90%**		**92%**		**94%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.6		6.4		6.2		6.3		6.4	
	CONDUCTIVITY	NS	mS/cm	4.180		2.670		2.750		3.440		1.861	
	TURBIDITY	NS	NTU	22		12		26		24		11	
	DISSOLVED OXYGEN	NS	mg/L	1.5		NT		2.1		2.8		7.6	
	TEMPERATURE	NS	°C	15.2		10.5		16.1		19.7		12.0	
	ORP	NS	mV	77		162		50		214		155	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIG

< = NOT DETECTED

NS = NO STANDARD NT = NOT

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date 09/10/2014		Date 04/08/2015		Date 09/17/2015		Date 03/31/2016		Date 08/12/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	100	1	1	<	1	17	1	<	10
	1,1,1-Trichloroethane	NS	µg/L	<	100	3	1	3	1	2	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	100	2	1	2	1	15	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	100	2	1	2	1	2	1	<	1
	1,1-Dichloroethene	7	µg/L	<	100	**8**	1	6	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	<	100	2	1	7	1	352	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	100	8	1	5	1	16	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	518	100	456	200	504	200	147	200	390	200
	Toluene	1,700	µg/L	123	100	70	1	53	1	62	1	39	
	Trichloroethene	540	µg/L	**17,800**	1,000	**11,800**	200	**16,400**	200	**9,510**	200	**11,700**	200
	Tetrachloroethene	150	µg/L	**587**	100	**868**	200	**946**	200	**599**	200	**905**	200
	Total VOCs	NS	µg/L	**19,028**		**13,314**		**17,973**		**11,168**		**13,034**	
	% Parent Products	NS	%	**97%**		**95%**		**97%**		**91%**		**97%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.2		6.5		6.6		6.4		6.4	
	CONDUCTIVITY	NS	mS/cm	2.740		3.690		3.810		4.110		3.949	
	TURBIDITY	NS	NTU	15		5		59		28		35	
	DISSOLVED OXYGEN	NS	mg/L	1.4		0.9		0.9		5.5		1.4	
	TEMPERATURE	NS	°C	19.2		10.0		22.0		14.6		20.9	
	ORP	NS	mV	8		79		49		185		205	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIG

< = NOT DETECTED

NS = NO STANDARD NT = NOT

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 10: Former Plating Facility Groundwater Monitoring Results for GZ-3

GZ-3 (Side Gradient)		RIDEM GB Groundwater Objectives	Units	Date 03/29/2017		Date 09/26/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**333**	10	**40.3**	1	**45.1**	1	**21.9**	1	**7.4**	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	1	1	1	1	1	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	6	1	2	1	3	1	2	1	2	1
	1,2-Dichloroethane	110	µg/L	3	1	1	1	1	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	2	1	2	1	<	1	2	1
	cis-1,2-Dichloroethene	2,400	µg/L	**2,540**	200	910	100	533	100	203	100	143	100
	Toluene	1,700	µg/L	4	1	2	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	**3,120**	200	**2,170**	100	**3,290**	100	**4,740**	100	**4,710**	100
	Tetrachloroethene	150	µg/L	75	200	84	1	**157**	1	**224**	1	**313**	1
	Total VOCs	NS	µg/L	**6,101**		**3,296**		**4,048**		**5,195**		**5,181**	
	% Parent Products	NS	%	**52%**		**68%**		**85%**		**96%**		**97%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.8		7.3		6.3		7.2		6.9	
	CONDUCTIVITY	NS	mS/cm	2.840		2.860		2.701		4.320		3.400	
	TURBIDITY	NS	NTU	33		NT		5		36		25	
	DISSOLVED OXYGEN	NS	mg/L	0.3		6.2		2.8		0.3		0.4	
	TEMPERATURE	NS	°C	12.3		21.5		10.3		20.1		12.8	
	ORP	NS	mV	-81		-73		-7		-42		-66	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIG

< = NOT DETECTED

NS = NO STANDARD NT = NOT

BGS = BELOW GROUND SURFACE

Well Screen From 10'-20' BGS

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 8/24/2011		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date (Blind Duplicate) 06/04/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	10	1	2	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	1	1	4	1	3	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	4	1	<	1	3	1	4	1	3	1
	1,2-Dichloroethane	110	µg/L	9	1	6	1	<	1	1	1	1	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	3	1	3	1	3	1	3	1
	cis-1,2-Dichloroethene	2,400	µg/L	146	50	106	1	129	1	107	10	98	10
	Trichloroethene	540	µg/L	**3,210**	50	**1,400**	50	**636**	50	434	10	482	10
	Tetrachloroethene	150	µg/L	**1,180**	50	**366**	50	127	50	91	10	98	10
	Total VOCs	NS	µg/L	**4,624**		**2,026**		**997**		**691**		**733**	
	% Parent Products	NS	%	**95%**		**87%**		**76%**		**76%**		**79%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.8		5.7		6.2		NT		6.2	
	CONDUCTIVITY	NS	mS/cm	0.376		6.260		4.070		NT		2.110	
	TURBIDITY	NS	NTU	1649		25		NT		NT		17	
	DISSOLVED OXYGEN	NS	mg/L	4.3		3.3		8.5		NT		0.9	
	TEMPERATURE	NS	°C	22.2		16.2		13.1		NT		21.3	
	ORP	NS	mV	334		93		168		NT		81	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 08/29/2012		Date 12/07/2012		Date 03/06/2013		Date 06/06/2013		Date 09/05/2013	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	<	1	**3**	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	2	1	<	1	1	1	2	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	2	1	8	1
	1,1-Dichloroethene	7	µg/L	3	1	2	1	<	1	2	1	3	1
	1,2-Dichloroethane	110	µg/L	2	1	1	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	2	1	<	1	2	1	4	1
	cis-1,2-Dichloroethene	2,400	µg/L	130	10	142	10	20	1	239	1	454	1
	Trichloroethene	540	µg/L	406	10	**547**	10	171	10	**1,110**	10	**3,680**	10
	Tetrachloroethene	150	µg/L	63	10	48	10	23	1	64	1	70	1
	Total VOCs	NS	µg/L	**691**		**823**		**227**		**1,421**		**4,244**	
	% Parent Products	NS	%	**68%**		**72%**		**86%**		**83%**		**88%**	
	FIELD PARAMETERS												
	pH	NS	SU	NT		6.5		7.0		6.7		6.8	
	CONDUCTIVITY	NS	mS/cm	NT		2.070		1.274		1.810		2.370	
	TURBIDITY	NS	NTU	NT		12		18		15		230	
	DISSOLVED OXYGEN	NS	mg/L	NT		1.0		NT		5.0		1.4	
	TEMPERATURE	NS	°C	NT		16.3		10.5		14.8		20.8	
	ORP	NS	mV	NT		91		0.8		-15		245	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 03/18/2014		Date 09/10/2014		Date 04/08/2015		Date 03/31/2016		Date 10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**2**	1	**11**	1	**5**	1	1	50	2	50
	1,1,1-Trichloroethane	NS	µg/L	2	1	4	1	<	1	<	50	<	50
	1,1,2-Trichloroethane	NS	µg/L	<	1	3	1	<	1	<	50	2	50
	1,1-Dichloroethane	NS	µg/L	7	1	23	1	10	1	5	50	11	50
	1,1-Dichloroethene	7	µg/L	2	1	4	1	2	1	<	50	2	50
	1,2-Dichloroethane	110	µg/L	2	1	5	1	2	1	1	50	3	50
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	5	1	2	1	1	50	1	50
	cis-1,2-Dichloroethene	2,400	µg/L	351	100	1,220	200	285	100	127	50	437	50
	Trichloroethene	540	µg/L	**3,750**	100	**15,500**	200	**4,710**	100	**2,560**	500	**3,540**	500
	Tetrachloroethene	150	µg/L	81	1	52	1	47	1	33	50	22	50
	Total VOCs	NS	µg/L	**4,242**		**16,881**		**5,073**		**2,732**		**4,042**	
	% Parent Products	NS	%	**90%**		**92%**		**94%**		**95%**		**88%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.6		6.6		6.8		6.7		7.5	
	CONDUCTIVITY	NS	mS/cm	1.094		2.160		9.57		10.49		0.68	
	TURBIDITY	NS	NTU	10		11		<5		48		6	
	DISSOLVED OXYGEN	NS	mg/L	3.8		2.2		3.9		10.4		7.3	
	TEMPERATURE	NS	°C	10.9		19.1		10.1		13.9		21.4	
	ORP	NS	mV	170		121		247.8		179		71	

Notes:

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BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 11: Former Plating Facility Groundwater Monitoring Results for GZ-4

GZ-4 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 03/29/2017		Date 09/26/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	**2**	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	4	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	1	1	<	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	1	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	1	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	33	1	279	1	70	1	31	1	2	1
	Trichloroethene	540	µg/L	234	10	**2,020**	1	417	10	416	10	38	10
	Tetrachloroethene	150	µg/L	3	1	17	1	4	1	6	1	1	1
	Total VOCs	NS	µg/L	**271**		**2,331**		**491**		**453**		**41**	
	% Parent Products	NS	%	**88%**		**87%**		**86%**		**93%**		**95%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.9		7.7		6.8		6.9		6.8	
	CONDUCTIVITY	NS	mS/cm	5.71		3.56		5.58		4.21		5.10	
	TURBIDITY	NS	NTU	11		NT		4		>5		>5	
	DISSOLVED OXYGEN	NS	mg/L	0.5		6.8		3.6		1.4		0.8	
	TEMPERATURE	NS	°C	10.3		21.2		8.6		20.3		11.6	
	ORP	NS	mV	131		180		297		157		144	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND

< = NOT DETECTED

NS = NO STANDARD NT = NOT

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 8/24/2011		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
	VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	1.4	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	32	1	5	1	<	1	6	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	1	1	2	1	<	1	1	1	1	1
	1,1-Dichloroethane	NS	µg/L	3	1	2	1	<	1	3	1	4	1
	1,1-Dichloroethene	7	µg/L	**133**	1	**13**	1	<	1	4	1	<	1
	1,2-Dichloroethane	110	µg/L	2	1	3	1	1	1	3	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	2	1	<	1	4	1	2	1
	cis-1,2-Dichloroethene	2,400	µg/L	833	50	597	1	215	1	722	50	693	50
	Trichloroethene	540	µg/L	**1,840**	50	**1,700**	1	511	1	**1,700**	50	**909**	50
	Tetrachloroethene	150	µg/L	49	1	44	1	15	1	54	1	15	1
	Total VOCs	NS	µg/L	**2,906**		**2,651**		**938**		**2,714**		**2,006**	
	% Parent Products	NS	%	**65%**		**66%**		**56%**		**65%**		**46%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.7		5.6		5.2		NT		6.0	
	CONDUCTIVITY	NS	mS/cm	0.971		2.900		2.455		NT		2.360	
	TURBIDITY	NS	NTU	522		>500		NT		NT		NT	
	DISSOLVED OXYGEN	NS	mg/L	2.3		8.6		9.3		NT		4.9	
	TEMPERATURE	NS	°C	20.2		16.0		17.1		NT		21.3	
	ORP	NS	mV	168		91		57		NT		-30	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 12/07/2012		Date 03/06/2013		Date 06/06/2013		Date 09/05/2013		Date 03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
	VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	**2**	1	<	1	<	1	**3**	1	**6**	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	1	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	6	1	5	1	<	1	<	1	6	1
	1,1-Dichloroethene	7	µg/L	6	1	5	1	<	1	**12**	1	**12**	1
	1,2-Dichloroethane	110	µg/L	2	1	2	1	<	1	<	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	5	1	5	1	6	1	2	1	5	1
	cis-1,2-Dichloroethene	2,400	µg/L	**2,560**	50	2,060	50	**3,140**	50	**1,320**	50	**1,980**	100
	Trichloroethene	540	µg/L	77	50	163	50	27	50	4	50	460	100
	Tetrachloroethene	150	µg/L	6	1	11	1	<	1	<	1	11	1
	Total VOCs	NS	µg/L	**2,951**		**2,319**		**3,210**		**1,433**		**2,577**	
	% Parent Products	NS	%	**3%**		**7%**		**1%**		**0.3%**		**18%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.0		7.0		6.6		6.4		6.7	
	CONDUCTIVITY	NS	mS/cm	1.990		1.460		1.320		0.450		1.001	
	TURBIDITY	NS	NTU	>500		16		55		>500		450	
	DISSOLVED OXYGEN	NS	mg/L	2.7		NT		1.5		5.9		0.8	
	TEMPERATURE	NS	°C	17.1		13.8		16.1		20.8		12.8	
	ORP	NS	mV	-80		-43		-8		-34		-34	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NO

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 09/10/2014		Date 04/08/2015		Date 09/17/2015		Date 03/31/2016		Date 10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**3**	1	<	1	1	1	<	1	36	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	1	1	2	1	2	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	5	1	3	1	7	1	6	1	6	1
	1,1-Dichloroethene	7	µg/L	**8**	1	<	1	**12**	1	2	1	4	1
	1,2-Dichloroethane	110	µg/L	2	1	<	1	1	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	<	1	2	1	1	1	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	**3,500**	100	194	50	2,020	50	433	50	507	50
	Trichloroethene	540	µg/L	397	100	**776**	50	**2,710**	50	**1,440**	50	**1,090**	50
	Tetrachloroethene	150	µg/L	10	1	10	1	11	1	17	1	10	1
	Total VOCs	NS	µg/L	**3,975**		**999**		**4,775**		**1,918**		**1,655**	
	% Parent Products	NS	%	**10%**		**79%**		**57%**		**76%**		**66%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.3		6.2		7.4		6.4		6.8	
	CONDUCTIVITY	NS	mS/cm	0.880		8.62		0.59		2.39		0.93	
	TURBIDITY	NS	NTU	>500		5		NT		>500		650	
	DISSOLVED OXYGEN	NS	mg/L	1.1		1.6		3.0		11.5		10.5	
	TEMPERATURE	NS	°C	19.5		11.3		23.6		13.6		14.2	
	ORP	NS	mV	-95		196		-14		95		130	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NO

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 12 Former Plating Facility Groundwater Monitoring Results for GZ-5

GZ-5 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 03/29/2017		Date 09/26/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	**10**	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	2	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	**25**	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	39	50	49	1	26	1	100	1	2	1
	Trichloroethene	540	µg/L	196	50	104	10	72	10	309	10	7	10
	Tetrachloroethene	150	µg/L	2	1	<	1	1	1	3	1	<	1
	Total VOCs	NS	µg/L	**237**		**155**		**98**		**448**		**9**	
	% Parent Products	NS	%	**84%**		**67%**		**74%**		**70%**		**78%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.7		7.5		6.8		6.1		6.3	
	CONDUCTIVITY	NS	mS/cm	2.87		3.21		2.70		4.03		3.05	
	TURBIDITY	NS	NTU	20		NT		68		67		52	
	DISSOLVED OXYGEN	NS	mg/L	0.5		8.2		6.4		1.5		0.9	
	TEMPERATURE	NS	°C	11.4		26.0		8.7		20.1		12.8	
	ORP	NS	mV	126		120		155		143		130	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NO

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 8/24/2011		Date 12/05/2011		Date 02/24/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
	VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	5	1	2	1	<	1	2	1	2	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	1	1	<	1	<	1	1	1
	1,1-Dichloroethane	NS	µg/L	1	1	<	1	4	1	1	1	<	1
	1,1-Dichloroethene	7	µg/L	**7**	1	<	1	<	1	<	2	2	2
	1,2-Dichloroethane	110	µg/L	8	1	6	1	<	1	5	1	9	1
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	1.1	1	<	1	1.4	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	134	50	102	50	52.0	50	113	20	106	20
	Trichloroethene	540	µg/L	**1,720**	50	**998**	50	529	50	**1,390**	20	**1,540**	20
	Tetrachloroethene	150	µg/L	**500**	50	**204**	50	**182**	50	**453**	20	**533**	20
	Total VOCs	NS	µg/L	**2,400**		**1,316**		**767**		**1,969**		**2,196**	
	% Parent Products	NS	%	**93%**		**91%**		**93%**		**94%**		**94%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.6		6.4		6.9		NT		6.1	
	CONDUCTIVITY	NS	mS/cm	2.681		4.910		5.011		NT		2.550	
	TURBIDITY	NS	NTU	934		5		NT		NT		6	
	DISSOLVED OXYGEN	NS	mg/L	7.4		8.3		6.8		NT		8.0	
	TEMPERATURE	NS	°C	22.7		18.4		7.8		NT		22.7	
	ORP	NS	mV	171		110		146		NT		167	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and allowed to recover prior to sampling.

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 12/07/2012		Date 03/06/2013		Date 06/06/2013		Date 09/05/2013		Date 03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
	VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	3	1	<	1	2	1	1	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	4	2	<	2	2	2	2	2	<	1
	1,2-Dichloroethane	110	µg/L	9	1	<	1	<	1	5	1	1	1
	trans-1,2-Dichloroethene	2,800	µg/L	3	1	<	1	2	1	1	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	120	20	34	1	102	1	81	1	68	1
	Trichloroethene	540	µg/L	**1,620**	20	322	20	**1,480**	20	**1,360**	20	518	10
	Tetrachloroethene	150	µg/L	**396**	20	**180**	20	**415**	20	**325**	20	**210**	10
	Total VOCs	NS	µg/L	**2,161**		**549**		**2,007**		**1,774**		**805**	
	% Parent Products	NS	%	**93%**		**91%**		**94%**		**95%**		**90%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.7		6.4		7.1		6.1		6.2	
	CONDUCTIVITY	NS	mS/cm	2.410		1.640		1.530		3.450		0.837	
	TURBIDITY	NS	NTU	19		3		28		>500		8	
	DISSOLVED OXYGEN	NS	mg/L	3.8		NT		7.1		7.2		0.8	
	TEMPERATURE	NS	°C	15.7		14.0		18.6		22.1		14.5	
	ORP	NS	mV	237		150		95		184		157	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 09/10/2014		Date 04/08/2015		Date 09/16/2015		Date 03/31/2016		Date 10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
	VOLATILE ORGANICS												
EPA 8260	Vinyl Chloride	2	µg/L	<	1	**4**	1	**2**	1	**10**	1	**5**	1
	1,1,1-Trichloroethane	NS	µg/L	2	1	<	1	1	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	1	1	3	1	5	1
	1,1-Dichloroethene	7	µg/L	3	1	<	1	2	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	5	1	<	1	3	1	<	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	<	1	1	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	87	50	119	10	160	10	208	10	294	50
	Trichloroethene	540	µg/L	**950**	50	**266**	10	**1,260**	10	**798**	10	**1,390**	50
	Tetrachloroethene	150	µg/L	118	50	52	1	**174**	1	81	1	84	1
	Total VOCs	NS	µg/L	**1,172**		**440**		**1,610**		**1,104**		**1,795**	
	% Parent Products	NS	%	**91%**		**72%**		**89%**		**80%**		**82%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.6		6.0		6.1		5.9		5.8	
	CONDUCTIVITY	NS	mS/cm	1.360		1.70		2.15		4.56		NT	
	TURBIDITY	NS	NTU	52		8		62		13		9	
	DISSOLVED OXYGEN	NS	mg/L	1.9		3.0		5.5		8.3		8.4	
	TEMPERATURE	NS	°C	20.5		12.5		26.6		16.6		17.9	
	ORP	NS	mV	67		118		177		199		188	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and

Table 13 Former Plating Facility Groundwater Monitoring Results for GZ-6

GZ-6 (Down Gradient) Screen From 7'-17' BGS		RIDEM GB Groundwater Objectives	Units	Date 03/29/2017		Date 09/26/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
	VOLATILE ORGANICS												
	Vinyl Chloride	2	µg/L	**3**	1	**5**	1	1	1	**4**	1	1.5	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	3	1	2	1	2	1	<	1
EPA 8260	1,1-Dichloroethene	7	µg/L	<	1	2	1	<	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	1	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	246	20	268	50	247	20	233	20	114	20
	Trichloroethene	540	µg/L	**895**	20	**1,320**	50	475	20	**914**	20	316	20
	Tetrachloroethene	150	µg/L	38	1	**89**	50	6	1	23	1	7	1
	Total VOCs	NS	µg/L	**1,191**		**1,710**		**735**		**1,178**		**438**	
	% Parent Products	NS	%	**78%**		**82%**		**65%**		**80%**		**74%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.6		NT		5.4		5.5		5.6	
	CONDUCTIVITY	NS	mS/cm	4.31		NT		4.38		3.59		4.12	
	TURBIDITY	NS	NTU	36		NT		12		0		2	
	DISSOLVED OXYGEN	NS	mg/L	0.3		NT		7.8		1.8		0.6	
	TEMPERATURE	NS	°C	14.3		NT		12.2		21.2		13.0	
	ORP	NS	mV	169		NT		227		190		202	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

1. Air induced prior to stabilization on 09/26/2017. Pump shut off and

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date Baseline		Date 12/05/2011		Date (Blind Duplicate) 12/05/2011		Date 02/24/2012		Date (Blind Duplicate) 02/24/2012		Date 06/04/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**														
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	106	20	10	1	11	1	2	1	<	1	2	1
	1,1-Dichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	**61**	1	6	1	7	1	<	1	<	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	7	1	3	1	3	1	3	1	3	1	6	1
	Trichloroethene	540	µg/L	**797**	20	203	10	198	10	82	10	79	10	156	10
	Tetrachloroethene	150	µg/L	39	1	7	1	7	1	5	1	4	1	10	1
	Total VOCs	NS	µg/L	**1,017**		**230**		**226**		**92**		**87**		**175**	
	% Parent Products	NS	%	**82%**		**91%**		**91%**		**94%**		**96%**		**95%**	
	FIELD PARAMETERS														
	pH	NS	SU	6.6		5.8		NA		6.6		NA		NT	
	CONDUCTIVITY	NS	mS/cm	0.599		1.195		NA		1.015		NA		NT	
	TURBIDITY	NS	NTU	>1000		>1000		NA		NT		NA		NT	
	DISSOLVED OXYGEN	NS	mg/L	2.2		2.4		NA		6.2		NA		NT	
	TEMPERATURE	NS	°C	21.2		17.3		NA		9.2		NA		NT	
	ORP	NS	mV	126		136		NA		67		NA		NT	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 08/29/2012		Date 12/07/2012		Date 03/06/2013		Date (Blind Duplicate) 03/06/2013		Date 06/06/2013		Date 09/05/2013	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**														
	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	1	1	1	1	<	1	<	1	<	1	1	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	1	1	1	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	8	1	10	1	3	1	3	1	10	1	9	1
	Trichloroethene	540	µg/L	127	10	205	10	44	1	43	1	136	1	214	1
	Tetrachloroethene	150	µg/L	6	1	12	1	4	1	4	1	7	1	7	1
	Total VOCs	NS	µg/L	**145**		**231**		**51**		**49**		**153**		**231**	
	% Parent Products	NS	%	**92%**		**94%**		**95%**		**95%**		**93%**		**96%**	
	FIELD PARAMETERS														
	pH	NS	SU	5.8		5.8		6.6		NA		6.5		6.0	
	CONDUCTIVITY	NS	mS/cm	7.680		7.890		8.060		NA		5.880		6.800	
	TURBIDITY	NS	NTU	NT		NT		NT		NA		>1000		>500	
	DISSOLVED OXYGEN	NS	mg/L	3.0		6.9		NT		NA		7.2		6.6	
	TEMPERATURE	NS	°C	20.8		17.4		12.5		NA		16.9		21.7	
	ORP	NS	mV	147		159		84.9		NA		91		225	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date (Blind Duplicate) 09/05/2013		Date 10/13/2016		Date 03/29/2017		Date 04/08/2015		Date 09/16/2015		Date 03/31/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**														
	Vinyl Chloride	2	µg/L	<	1	17	1	8	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1		1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	10	1	386	1	26	1	3	1	16	1	18	1
	Trichloroethene	540	µg/L	207	1	1	10	1	10	63	1	139	1	175	1
	Tetrachloroethene	150	µg/L	7	1	0	1	0	1	16	1	4	1	24	1
	Total VOCs	NS	µg/L	**225**		**2**		**1**		**81**		**159**		**217**	
	% Parent Products	NS	%	**95%**		**80%**		**49%**		**97%**		**90%**		**92%**	
	FIELD PARAMETERS														
	pH	NS	SU	NA		9.5				6.0		6.3		5.4	
	CONDUCTIVITY	NS	mS/cm	NA		16.400				13.61		6.02		11.34	
	TURBIDITY	NS	NTU	NA		147.0				high		78.0		3.0	
	DISSOLVED OXYGEN	NS	mg/L	NA		3.65		3.65		4.89		5.53		1.25	
	TEMPERATURE	NS	°C	NA		14.6		14.6		12.6		24.5		15.9	
	ORP	NS	mV	NA		121		121		59.1		91		179	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 14 Former Plating Facility Groundwater Monitoring Results for GZ-7

GZ-7 (Down Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 10/19/2016		Date 03/19/2017		Date 09/26/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**														
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	2	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	19	1	4	1	12	1	1	1	<	1	<	1
	Trichloroethene	540	µg/L	6	1	41	1	63	1	16	1	13	1	4	1
	Tetrachloroethene	150	µg/L	124	10	3	1	2	1	1	1	1	1	<	1
	Total VOCs	NS	µg/L	**150**		**49**		**77**		**18**		**14**		**4**	
	% Parent Products	NS	%	**87%**		**89%**		**85%**		**94%**		#####		#####	
	FIELD PARAMETERS														
	pH	NS	SU	6.0		NT		6.6		6.7		6.3		6.4	
	CONDUCTIVITY	NS	mS/cm	0.83		NT		7.01		9.13		9.10		8.61	
	TURBIDITY	NS	NTU	156.0		NT		NT		88.2		<5		15	
	DISSOLVED OXYGEN	NS	mg/L	7.64		NT		7.03		6.74		4.4		5.2	
	TEMPERATURE	NS	°C	20.7		NT		23		14.8		20.8		13.1	
	ORP	NS	mV	267		NT		160		188		171		193	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 8/24/2011		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	**10**	1	**4**	1	**6**	1	**7**	1
	1,1,1-Trichloroethane	3,100	µg/L	<	1	7	1	4	1	3	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	1	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	4	1	2	1	2	1	1	1
	1,1-Dichloroethene	7	µg/L	<	1	**9**	1	<	1	6	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	4	1	1	1	1	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	112	100	**3,240**	100	1,500	100	**3,720**	50	**3,740**	50
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	3	1	1	1	5	1	3	1
	Ethylbenzene	1,600	µg/L	<	1	2	1	<	1	1	1	<	1
	Trichloroethene	540	µg/L	**7,960**	100	**1,150**	100	204	100	206	50	70	50
	Tetrachloroethene	150	µg/L	**9,180**	1,000	**1,520**	100	**642**	100	**572**	50	**284**	50
	Toluene	1,700	µg/L	<	1	4	1	1	1	2	1	2	1
	Total VOCs	NS	µg/L	**17,252**		**6,090**		**2,442**		**4,569**		**4,135**	
	% Parent Products	NS	%	**99%**		**44%**		**35%**		**17%**		**9%**	
	FIELD PARAMETERS												
	pH	NS	SU	4.5		6.9		7.0		7.1		8.1	
	CONDUCTIVITY	NS	mS/cm	1.221		2.100		1.639		0.860		1.100	
	TURBIDITY	NS	NTU	43		7		NT		NT		NT	
	DISSOLVED OXYGEN	NS	mg/L	2.1		1.1		6.2		1.0		5.6	
	TEMPERATURE	NS	°C	19.5		15.5		14.4		15.7		29.0	
	ORP	NS	mV	240		-111		-141		-151		0	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 12/07/2012		Date 03/06/2013		Date 06/06/2013		Date 09/05/2013		Date 03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	1.7	1	<	1	<	1	1	1	1	1
	1,1,1-Trichloroethane	3,100	µg/L	1	1	4	1	2	1	1	1	3	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	1	1	<	1	<	1	1	1
	1,1-Dichloroethene	7	µg/L	2	1	1	1	<	1	<	1	3	1
	1,2-Dichloroethane	110	µg/L	<	1	1	1	<	1	<	1	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	1,850	50	788	200	243	200	464	50	315	100
	trans-1,2-Dichloroethene	2,800	µg/L	2	1	<	1	<	1	<	1	<	1
	Ethylbenzene	1,600	µg/L	<	1	<	1	<	1	<	1	2	1
	Trichloroethene	540	µg/L	247	50	**1,190**	200	**762**	100	327	50	**2,240**	100
	Tetrachloroethene	150	µg/L	**268**	50	**1,600**	200	**1,130**	100	**986**	50	**4,650**	100
	Toluene	1,700	µg/L	1	1	2	1	<	1	1	1	5	1
	Total VOCs	NS	µg/L	**2,393**		**3,592**		**2,138**		**1,825**		**7,249**	
	% Parent Products	NS	%	**22%**		**78%**		**88%**		**72%**		**95%**	
	FIELD PARAMETERS												
	pH	NS	SU	7.3		6.9		8.6		6.6		6.7	
	CONDUCTIVITY	NS	mS/cm	0.890		0.980		1.080		1.460		1.235	
	TURBIDITY	NS	NTU	7		35		22		58		70	
	DISSOLVED OXYGEN	NS	mg/L	2.1		NT		2.0		1.0		2.8	
	TEMPERATURE	NS	°C	17.0		14.0		17.3		22.3		12.3	
	ORP	NS	mV	-85		-39		78		-12		48	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 09/10/2014		Date 04/08/2015		Date 09/17/2015		Date 03/31/2016		Date 10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	1	1	<	1
	1,1,1-Trichloroethane	3,100	µg/L	<	1	<	1	1	1	<	1	3	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	2	1	<	1	<	1	<	1	1	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	92	1	49	1	23	1	202	1	26	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	Ethylbenzene	1,600	µg/L	<	1	<	1	2	1	<	1	3	1
	Trichloroethene	540	µg/L	**546**	20	**552**	100	**971**	100	**536**	100	**892**	100
	Tetrachloroethene	150	µg/L	**977**	20	**2,000**	100	**4,150**	100	**1,910**	100	**7,800**	100
	Toluene	1,700	µg/L	2	1	1	1	2	1	2	1	2	1
	Total VOCs	NS	µg/L	**1,618**		**2,625**		**5,195**		**2,674**		**8,778**	
	% Parent Products	NS	%	**94%**		**97%**		**99%**		**91%**		**99%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.8		6.6		5.5		4.6		5.3	
	CONDUCTIVITY	NS	mS/cm	1.350		29.170		4.220		10.82		0.786	
	TURBIDITY	NS	NTU	65		5		8		10		<	
	DISSOLVED OXYGEN	NS	mg/L	2.2		2.9		3.6		14.5		7.9	
	TEMPERATURE	NS	°C	20.1		10.8		21.6		13.1		20.2	
	ORP	NS	mV	25		-19		63		178		173	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD NT = NOT TESTED

BGS = BELOW GROUND SURFACE

Table 15 Former Plating Facility Groundwater Monitoring Results for GZ-8

GZ-8 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				03/29/2017		09/21/2017		03/29/2018		09/27/2018		03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	3,100	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	<	1	<	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	9	1	12	1	153	20	11	20	5	20
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	Ethylbenzene	1,600	µg/L	<	1	<	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	151	100	56	1	15	1	19	1	16	1
	Tetrachloroethene	150	µg/L	**2,000**	100	**801**	100	**394**	20	102	10	109	10
	Toluene	1,700	µg/L	<	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	**2,181**		**885**		**562**		**133**		**129**	
	% Parent Products	NS	%	**99%**		**97%**		**73%**		**92%**		**96%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.5		NT		8.2		8.7		7.4	
	CONDUCTIVITY	NS	mS/cm	7.8		NT		17.9		7.0		7.1	
	TURBIDITY	NS	NTU	39		NT		NT		<5		<5	
	DISSOLVED OXYGEN	NS	mg/L	0.5		NT		8.4		0.4		1.2	
	TEMPERATURE	NS	°C	12.5		NT		8.2		19.7		12.4	
	ORP	NS	mV	143		NT		143.2		-16		126	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 8/24/2011		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	**2**	1	<	1	**14**	1	**13**	1
	1,1,1-Trichloroethane	NS	µg/L	10	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	2	1	<	1	2	1	5	1
	1,1-Dichloroethene	7	µg/L	2	1	<	1	<	1	5	1	**8**	1
	1,2-Dichloroethane	110	µg/L	4	1	2	1	<	1	3	1	3	1
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	1	1	<	1	2	1	3	1
	cis-1,2-Dichloroethene	2,400	µg/L	705	50	989	1	390	1	1,650	50	**2,430**	50
	Trichloroethene	540	µg/L	**2,290**	50	167	1	23	1	1	1	1	1
	Tetrachloroethene	150	µg/L	63	1	9	1	2	1	<	1	<	1
	Total VOCs	NS	µg/L	**3,090**		**1,951**		**752**		**1,999**		**2,501**	
	% Parent Products	NS	%	**76%**		**9%**		**3%**		**0.1%**		**0.1%**	
	FIELD PARAMETERS												
	pH	NS	SU	7.1		7.1		7.6		NT		6.7	
	CONDUCTIVITY	NS	mS/cm	0.800		3.330		2.480		NT		1.980	
	TURBIDITY	NS	NTU	>1000		>1000		NT		NT		NT	
	DISSOLVED OXYGEN	NS	mg/L	7.8		4.5		7.1		NT		0.8	
	TEMPERATURE	NS	°C	21.6		14.9		15.8		NT		23.1	
	ORP	NS	mV	172		-129		-151		NT		-61	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

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BGS = BELOW GROUND SURFACE

Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 12/07/2012		Date 03/06/2013		Date 06/06/2013		Date 09/05/2013		Date 03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**29**	1	**75**	1	<	1	**113**	1	**103**	100
	1,1,1-Trichloroethane	NS	µg/L	1	1	3	1	<	1	<	1	<	100
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	100
	1,1-Dichloroethane	NS	µg/L	<	1	12	1	<	1	53	1	<	100
	1,1-Dichloroethene	7	µg/L	**14**	1	**16**	1	<	1	**26**	1	<	100
	1,2-Dichloroethane	110	µg/L	4	1	6	1	<	1	14	1	<	100
	trans-1,2-Dichloroethene	2,800	µg/L	4	1	10	1	<	1	<	1	<	100
	cis-1,2-Dichloroethene	2,400	µg/L	1,850	50	**5,000**	500	**11,600**	500	**10,000**	50	**29,300**	1,000
	Trichloroethene	540	µg/L	9	1	41	1	<	1	13	50	**680**	100
	Tetrachloroethene	150	µg/L	1	1	2	1	<	1	<	10	<	100
	Total VOCs	NS	µg/L	**1,938**		**5,210**		**11,600**		**10,218**		**30,083**	
	% Parent Products	NS	%	**1%**		**1%**				**0.1%**		**2%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.6		6.4		6.8		6.4		6.5	
	CONDUCTIVITY	NS	mS/cm	1.830		1.400		1.670		1.790		1.060	
	TURBIDITY	NS	NTU	>500		99		50		140		24	
	DISSOLVED OXYGEN	NS	mg/L	0.8		NT		1.9		0.9		1.2	
	TEMPERATURE	NS	°C	18.1		12.2		16.3		22.7		12.4	
	ORP	NS	mV	-80		-68		-46		-70		-49	

Notes:

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Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 09/10/2014		Date 04/08/2015		Date 09/17/2015		Date 03/31/2016		Date 10/19/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**18**	1	<	1	**12**	1	**10**	1	**6**	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	100	<	1	<	1	1	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	100	<	1	1	1	2	1
	1,1-Dichloroethane	NS	µg/L	42	1	142	100	39	1	54	1	73	1
	1,1-Dichloroethene	7	µg/L	**19**	1	<	100	**15**	1	**16**	1	**27**	1
	1,2-Dichloroethane	110	µg/L	5	1	<	100	5	1	8	1	6	1
	trans-1,2-Dichloroethene	2,800	µg/L	74	1	<	100	72	1	553	1	65	1
	cis-1,2-Dichloroethene	2,400	µg/L	**11,100**	200	**34,900**	1,000	**10,500**	200	**16,500**	200	**17,300**	1,000
	Trichloroethene	540	µg/L	**1,890**	200	**7,220**	100	**1,000**	1	**3,550**	1	**4,760**	1,000
	Tetrachloroethene	150	µg/L	9	1	<	100	4	1	39	1	18	1
	Total VOCs	NS	µg/L	**13,248**		**42,262**		**11,676**		**20,769**		**22,281**	
	% Parent Products	NS	%	**14%**		**17%**		**9%**		**17%**		**21%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.5		6.7		6.6		6.5		7.2	
	CONDUCTIVITY	NS	mS/cm	1.060		1.59		1.12		2.23		2.41	
	TURBIDITY	NS	NTU	>500		high		>500		2		14	
	DISSOLVED OXYGEN	NS	mg/L	1.6		5.3		4.4		14.2		0.9	
	TEMPERATURE	NS	°C	20.5		11.5		22.3		13.6		22.7	
	ORP	NS	mV	-124		134		-101		-49		-27	

Notes:

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Table 16 Former Plating Facility Groundwater Monitoring Report for GZ-9

GZ-9 (Source Area) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 03/29/2017		Date 09/21/2017		Date 03/29/2018		Date 10/30/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**12**	1	**4**	1	**3**	1	**3**	1	**4**	1
	1,1,1-Trichloroethane	NS	µg/L	1	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	47	1	20	1	9	1	3	1	1	1
	1,1-Dichloroethene	7	µg/L	**31**	1	**17**	1	**12**	1	**9**	1	6	1
	1,2-Dichloroethane	110	µg/L	5	1	2	1	1	1		1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	130	1	96	1	44	1	22	1	6	1
	cis-1,2-Dichloroethene	2,400	µg/L	**17,300**	500	**11,800**	1,000	**6,260**	100	**5,800**	100	**3,540**	100
	Trichloroethene	540	µg/L	**9,040**	1,000	**3,650**	1,000	**3,410**	100	**2,420**	100	**1,950**	100
	Tetrachloroethene	150	µg/L	27	1	11	1	15	1	9	1	9	1
	Total VOCs	NS	µg/L	**26,613**		**15,609**		**9,755**		**8,266**		**5,516**	
	% Parent Products	NS	%	**34%**		**23%**		**35%**		**29%**		**36%**	
	FIELD PARAMETERS												
	pH	NS	SU	NT		NT		6.5		6.8		6.6	
	CONDUCTIVITY	NS	mS/cm	NT		NT		4.5		3.3		2.8	
	TURBIDITY	NS	NTU	NT		NT		292		<5		<5	
	DISSOLVED OXYGEN	NS	mg/L	NT		NT		3.5		4.6		2.4	
	TEMPERATURE	NS	°C	NT		NT		12.1		19.8		12.7	
	ORP	NS	mV	NT		NT		129		44		-30	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

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BGS = BELOW GROUND SURFACE

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 8/24/2011		Date 12/02/2011		Date 02/23/2012		Date 06/04/2012		Date 08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	1	1	<	1	<	1	1	1	**3**	1
	1,1,1-Tricholorethane	NS	µg/L	6	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	**8**	1	<	1	<	1	2	1	2	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	20	1	14	1	82	1	320	10	229	10
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	**719**	20	112	10	35	10	32	1	5	1
	Tetrachloroethene	150	µg/L	11	1	2	1	2	1	5	1	<	1
	Total VOCs	NS	µg/L	**765**		**1,340**		**185**		**415**		**287**	
	% Parent Products	NS	%	**95%**		**9%**		**20%**		**9%**		**2%**	
	FIELD PARAMETERS												
	pH	NS	SU	5.2		6.4		7.0		NT		6.3	
	CONDUCTIVITY	NS	mS/cm	0.743		2.510		1.672		NT		1.070	
	TURBIDITY	NS	NTU	699		>500		NT		NT		NT	
	DISSOLVED OXYGEN	NS	mg/L	0.8		8.1		9.8		NT		1.7	
	TEMPERATURE	NS	°C	18.2		14.8		15.2		NT		21.7	
	ORP	NS	mV	204		-9		-133		NT		-53	

Notes:

RIDEM GB EXCEEDANCES ARE IN BOLD AND HIGHLIGHTED GREEN

< = NOT DETECTED

NS = NO STANDARD

NT = NOT TESTED

BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 12/07/2012		Date 03/06/2013		Date 06/06/2013		Date 09/05/2013		Date 03/24/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**3**	1	**2**	1	1	1	**4**	1	**3**	1
	1,1,1-Tricholorethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	2	1	<	1	1	1	2	1	1	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	1	1
	cis-1,2-Dichloroethene	2,400	µg/L	265	10	224	10	252	10	321	10	251	10
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	1	1	1	1
	Trichloroethene	540	µg/L	2	1	3	1	4	1	5	1	34	1
	Tetrachloroethene	150	µg/L	1	1	<	1	<	1	<	1	5	1
	Total VOCs	NS	µg/L	**314**		**253**		**321**		**333**		**311**	
	% Parent Products	NS	%	**1%**		**1%**		**1%**		**1%**		**13%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.4		6.8		6.7		6.9		6.2	
	CONDUCTIVITY	NS	mS/cm	1.010		0.810		0.820		0.880		0.562	
	TURBIDITY	NS	NTU	>500		1352		500		>500		640	
	DISSOLVED OXYGEN	NS	mg/L	2.6		NT		3.3		7.1		0.4	
	TEMPERATURE	NS	°C	17.2		13.8		16.9		20.2		12.7	
	ORP	NS	mV	-86		-22		70		-25		-25	

Notes:

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1. Turbidity meter did not work on 09/26/2017

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				09/10/2014		04/08/2015		09/17/2015		03/31/2016		10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	**5**	1	**3**	1	**10**	1	**3**	1	**7**	1
	1,1,1-Tricholorethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	2	1	1	1	<	1
	1,1-Dichloroethene	7	µg/L	3	1	<	1	3	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	281	10	79	1	330	1	240	1	150	1
	Methyl tert-Butyl Ether	5,000	µg/L	2	1	1	1	3	1	1	1	2	1
	Trichloroethene	540	µg/L	28	1	51	1	57	1	89	1	77	1
	Tetrachloroethene	150	µg/L	<	1	13	1	2	1	61	1	2	1
	Total VOCs	NS	µg/L	**332**		**147**		**417**		**395**		**237**	
	% Parent Products	NS	%	**9%**		**35%**		**14%**		**23%**		**33%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.0		6.1		6.3		5.6		5.8	
	CONDUCTIVITY	NS	mS/cm	0.060		0.790		0.860		0.780		0.234	
	TURBIDITY	NS	NTU	>500		5		>500		>500		5	
	DISSOLVED OXYGEN	NS	mg/L	0.6		2.3		0.3		7.8		0.7	
	TEMPERATURE	NS	°C	19.7		11.5		19.6		13.1		16.5	
	ORP	NS	mV	-90		46		-144		102		73	

Notes:

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BGS = BELOW GROUND SURFACE

1. Turbidity meter did not work on 09/26/2017

Table 17 Former Plating Facility Groundwater Monitoring Results for GZ-10

GZ-10 (Side Gradient) Screen From 8'-18' BGS		RIDEM GB Groundwater Objectives	Units	Date 03/29/2017		Date 09/26/2017		Date 03/29/2018		Date 09/27/2018		Date 03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Tricholorethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethene	7	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	49	1	96	1	64	1	34	1	19	1
	Methyl tert-Butyl Ether	5,000	µg/L	<	1	<	1	<	1	<	1	<	1
	Trichloroethene	540	µg/L	46	1	31	1	56	1	41	1	43	1
	Tetrachloroethene	150	µg/L	3	1	<	1	2	1	2	1	2	1
	Total VOCs	NS	µg/L	**98**		**126**		**122**		**77**		**63**	
	% Parent Products	NS	%	**50%**		**24%**		**48%**		**56%**		**70%**	
	FIELD PARAMETERS												
	pH	NS	SU	NT		7.3		6.0		5.2		6.1	
	CONDUCTIVITY	NS	mS/cm	NT		0.910		2.44		3.19		2.64	
	TURBIDITY	NS	NTU	NT		NT		96		>5		>5	
	DISSOLVED OXYGEN	NS	mg/L	NT		8.6		7.9		1.0		1.3	
	TEMPERATURE	NS	°C	NT		23.1		12.8		20.2		13.1	
	ORP	NS	mV	NT		-32		185		210		166	

Notes:

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1. Turbidity meter did not work on 09/26/2017

Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				8/24/2011		12/05/2011		02/24/2012		06/04/2012		08/29/2012	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	12	1	4	1	2	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	2	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	7	1	10	1	11	1	7	1	3	1
	1,1-Dichloroethene	7	µg/L	**85**	1	**42**	1	**32**	1	**13**	1	4	1
	1,2-Dichloroethane	110	µg/L	4	1	3	1	2	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	58	1	40	1	43	1	120	10	147	10
	Trichloroethene	540	µg/L	**670**	20	331	20	266	20	27	1	6	1
	Tetrachloroethene	150	µg/L	34	1	12	1	105	1	5	1	2	1
	Total VOCs	NS	µg/L	**874**		**982**		**1,027**		**425**		**394**	
	% Parent Products	NS	%	**81%**		**35%**		**36%**		**8%**		**2%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.7		4.9		5.8		NT		NT	
	CONDUCTIVITY	NS	mS/cm	1.293		3.770		4.111		NT		NT	
	TURBIDITY	NS	NTU	1691		<100		NT		NT		NT	
	DISSOLVED OXYGEN	NS	mg/L	1.3		0.9		0.6		NT		NT	
	TEMPERATURE	NS	°C	27.3		15.2		12.9		NT		NT	
	ORP	NS	mV	276		99		-72		NT		NT	

Notes:

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1. Turbidity meter did not work on 09/26/2017

Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				12/07/2012		03/06/2013		06/06/2013		09/05/2013		03/18/2014	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	1	1	<	1	<	1	<	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	<	1	<	1	4	1	5	1	3	1
	1,1-Dichloroethene	7	µg/L	**12**	1	**8**	1	**17**	1	**23**	1	**13**	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	270	10	130	10	197	10	230	10	152	10
	Trichloroethene	540	µg/L	29	1	2	1	3	1	3	1	4	1
	Tetrachloroethene	150	µg/L	1	1	<	1	<	1	<	1	2	1
	Total VOCs	NS	µg/L	**302**		**160**		**222**		**261**		**174**	
	% Parent Products	NS	%	**10%**		**1%**		**1%**		**1%**		**4%**	
	FIELD PARAMETERS												
	pH	NS	SU	7.0		7.2		7.0		6.9		6.9	
	CONDUCTIVITY	NS	mS/cm	1.890		1.380		1.110		1.180		0.710	
	TURBIDITY	NS	NTU	>500		NT		900		>500		7	
	DISSOLVED OXYGEN	NS	mg/L	1.4		NT		0.4		1.3		3.2	
	TEMPERATURE	NS	°C	15.0		10.8		16.7		20.0		14.1	
	ORP	NS	mV	-129		-103		-95		-110		-36	

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1. Turbidity meter did not work on 09/26/2017

Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				09/10/2014		04/08/2015		09/16/2015		03/31/2016		10/13/2016	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	1	1	<	1	<	1	1	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	3	1	2	1	1	1	6	1
	1,1-Dichloroethene	7	µg/L	**35**	1	**26**	1	**18**	1	**14**	1	**16**	1
	1,2-Dichloroethane	110	µg/L	1	1	<	1	1	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	748	20	686	10	706	10	486	10	**4,360**	100
	Trichloroethene	540	µg/L	209	20	109	10	27	10	57	10	48	10
	Tetrachloroethene	150	µg/L	5	1	3	1	<	1	15	1	19	1
	Total VOCs	NS	µg/L	**1,004**		**827**		**755**		**573**		**4,449**	
	% Parent Products	NS	%	**21%**		**14%**		**4%**		**10%**		**1%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.7		6.9		6.9		6.9		NT	
	CONDUCTIVITY	NS	mS/cm	0.080		1.41		1.41		1.75		NT	
	TURBIDITY	NS	NTU	>1000		<5		11		23		NT	
	DISSOLVED OXYGEN	NS	mg/L	0.5		3.3		3.3		7.0		NT	
	TEMPERATURE	NS	°C	18.8		13.5		22.5		15.4		NT	
	ORP	NS	mV	-131		42		45		67		NT	

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Table 18 Former Plating Facility Groundwater Monitoring Report for MW-2D

MW-2D (Down Gradient) Screen From 25'-35' BGS (Approx.)		RIDEM GB Groundwater Objectives	Units	Date		Date		Date		Date		Date	
				03/29/2017		09/26/2017		03/29/2018		09/27/2018		03/20/2019	
				Result	Limit	Result	Limit	Result	Limit	Result	Limit	Result	Limit
EPA 8260	**VOLATILE ORGANICS**												
	Vinyl Chloride	2	µg/L	<	1	<	1	<	1	1.8	1	<	1
	1,1,1-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1,2-Trichloroethane	NS	µg/L	<	1	<	1	<	1	<	1	<	1
	1,1-Dichloroethane	NS	µg/L	3	1	5	1	2	1	3	1	2	1
	1,1-Dichloroethene	7	µg/L	**8**	1	5	1	3	1	3	1	3	1
	1,2-Dichloroethane	110	µg/L	<	1	<	1	<	1	<	1	<	1
	trans-1,2-Dichloroethene	2,800	µg/L	<	1	<	1	<	1	<	1	<	1
	cis-1,2-Dichloroethene	2,400	µg/L	247	100	101	100	81	1	65	1	73	1
	Trichloroethene	540	µg/L	25	10	15	1	18	1	12	1	11	1
	Tetrachloroethene	150	µg/L	<	1	<	1	<	1	<	1	<	1
	Total VOCs	NS	µg/L	**288**		**126**		**104**		**84**		**89**	
	% Parent Products	NS	%	**9%**		**12%**		**17%**		**14%**		**12%**	
	FIELD PARAMETERS												
	pH	NS	SU	6.9		7.3		7.3		NT		6.8	
	CONDUCTIVITY	NS	mS/cm	1.15		0.91		1.08		NT		1.02	
	TURBIDITY	NS	NTU	10		NT		217		NT		44.0	
	DISSOLVED OXYGEN	NS	mg/L	0.3		0.9		3.4		NT		1.1	
	TEMPERATURE	NS	°C	14.8		18.1		15.0		NT		13.0	
	ORP	NS	mV	123		-66		149		NT		-35.0	

Notes:

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APPENDICES

Appendix B – Dilution Evaluation

Appendix B - Dilution calculations

Central Landfill

The total volume of the first injection was approximately 1,250 gallons. The total volume of the second injection was approximately 800 gallons. The total volume of the third injection was approximately 2,000 gallons. The groundwater hydraulic conductivity is expected to range from 0.85 to 2.5 feet per day (based on the 3-9 months for changes in ML-11 to appear in ML-12 which is 230 feet downgradient). Based on literature from Regenesis, PlumeStop is expected to migrate at least 2 meters (6.5 feet) from the injection point. Meaning the radius of influence (ROI) would be at least 6.5 feet. Using an interconnected matrix porosity for gneiss of 0.01 (INTERA Environmental Consultants, Inc. 1983), the total flow of groundwater through the radius of influence can be estimated using the following equation. Note, the equation below assumes that the flow is perpendicular to an area that is equivalent to the depth of water in the borehole by twice the ROI.

$$Volume = Depth\ of\ Water * 2 * ROI * Porosity * Hydraulic\ Conductivity$$

$$Volume = (189\ ft - 83\ ft) * 13\ ft * 0.01 * 0.85\ \ ft/day = 11.7\ \ ft^3/day$$

The first injection was performed over five weeks, and the first sample after the injection was collected 77 days after the start of the first injection. The total volume of groundwater that passed through the ROI during that time period is estimated below.

$$Volume = \frac{volume}{day} * No.of\ days = 11.7\frac{ft^3}{day} * 77\ days$$

$$= 900.9\ ft^3\ or\ 6{,}738.7\ gallons$$

The estimated dilution due to the addition of the injectate is below

$$\frac{Volume\ Injectate}{Volume\ of\ flow\ through\ ROI} = \frac{1{,}250\ gallons}{6{,}738.7\ gallons} = 0.185$$

Therefore, the percent reduction in contaminant concentrations due to dilution alone for the first injection is estimated to be at most 18.5%. Note, the radius of influence may be larger which would lower the percent reduction in contaminant concentrations due to dilution alone. It is not possible to determine the actual ROI of the injections without performing soil borings. Additionally, the lowest value of hydraulic conductivity was used to determine the flow through the ROI as a conservative estimate. If the 2.5 feet per day hydraulic conductivity was used, then the percent reduction in contaminant concentrations due to dilution would be lower.

The concentration of 1,2-DCBz prior to the injection was 14,000 µg/L and the concentration after the first injection was 1,100 µg/L. The concentration of CBz prior to the first injection was 6,400 µg/L and the concentration after the first injection was 1,500 µg/L. The percent reduction in contaminant concentrations can be calculated as follows

$$\frac{C_1 - C_2}{C_1} * 100 = \%\ Reduction$$

$$\frac{14{,}000 - 1{,}100}{14{,}000} * 100 = 92.1\%$$

$$\frac{6{,}400 - 1{,}500}{6{,}400} * 100 = 76.5\%$$

Given that the percent reductions for 1,2-DCBz and CBz are more than 18.5%, it is unlikely that the reduction in contaminant concentrations is due to dilution alone, although dilution may be a contributing factor.

Calculations for the second injection

$$Volume = \frac{volume}{day} * No.of\ days = 11.7\frac{ft^3}{day} * 51\ days$$

$$= 596.7\ ft^3\ or\ 4{,}463\ gallons$$

$$\frac{Volume\ Injectate}{Volume\ of\ flow\ through\ ROI} = \frac{800\ gallons}{4{,}463\ gallons} = 0.179\ or\ 17.9\%$$

The concentration of 1,2-DCBz prior to the injection was 2,190 µg/L and the concentration after the first injection was below the method detection limit of 200 µg/L. The concentration of CBz prior to the first injection was 1,660 µg/L and the concentration after the first injection was below the method detection limit of 200 µg/L.

$$\frac{2{,}190 - 200}{2190} * 100 = 90.8\%$$

$$\frac{1{,}660 - 200}{1{,}660} * 100 = 87.9\%$$

Again, the reduction in contaminant concentrations cannot be contributed to dilution alone. These calculations cannot be completed for the third injection because there is no sampling data after the third injection.

Former Plating Facility

The total volume of injectate at the Former Plating Facility was approximately 5,300 gallons. The groundwater hydraulic conductivity is expected to range from 0.12 to 0.14 feet per day (based on the 12-14 months for groundwater to reach GZ-6, 50 feet downgradient). The injections were performed along the corner of the Site. The length of the injections perpendicular to groundwater flow direction is approximately 90 feet, and the injections were completed to 20 feet below grade. The depth to groundwater at the site is typically 9 to feet below grade. The soil at the site consists of silty sand, the porosity of silty sand is 0.25.

$$Volume = Depth\ of\ Water * 90\ feet * Porosity * Hydraulic\ Conductivity$$

$$Volume = (20\ ft - 10\ ft) * 90\ ft * 0.25 * 0.12 = 27\ ft^3/day$$

The first samples were collected 58 days after the injection. The total volume of groundwater that passed through the area of the injectate during that time period is estimated below.

$$Volume = \frac{volume}{day} * No.\ of\ days = 27\frac{ft^3}{day} * 58\ days$$

$$= 1{,}566\ ft^3\ or\ 11{,}713.7\ gallons$$

The estimated dilution due to the addition of the injectate is below

$$\frac{Volume\ Injectate}{Volume\ of\ flow\ through\ ROI} = \frac{5{,}300\ gallons}{11{,}713.7\ gallons} = 0.452$$

Therefore, the percent reduction in contaminant concentrations due to dilution alone for the first injection is estimated to be at most 45.2%. Dilution could be influencing the results however, the concentration of some contaminants increased after the injection, therefore it is unlikely that dilution is occurring.

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